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- Life expectancy in the Inuit-inhabited areas of Canada, 1989 to 2003
- Obesity and the eating habits of the Aboriginal population
- Chronic pain in Canadian seniors
- Health care use among gay, lesbian and bisexual Canadians
- Getting a second opinion: Health information and the Internet
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Life expectancy in the Inuit-inhabited areas of Canada, 1989 to 2003

Russell Wilkins, Sharanjit Uppal, Philippe Finès, Sacha Senécal, Éric Guimond and Rene Dion

Abstract

Objectives

Because of a lack of Aboriginal identifiers on death registrations, standard data sources and methods cannot be used to estimate basic health indicators for Inuit in Canada. Instead, a geographic-based approach was used to estimate life expectancy for the entire population of Inuit-inhabited areas.

Data sources

The data are from the Canadian Mortality Database and the Census of Canada.

Analytical techniques

Areas where at least 33% of residents were Inuit were identified, based on census results. Vital statistics death records for 1989 through 2003 and census population counts for 1991, 1996 and 2001 were used to compute abridged life tables for the Inuit-inhabited areas in each of the three 5-year periods centered around those census years.

Main results

In 1991, life expectancy at birth in the Inuit-inhabited areas was about 68 years, which was 10 years lower than for Canada overall. From 1991 to 2001, life expectancy in the Inuit-inhabited areas did not increase, although it rose by about two years for Canada as a whole. As a result, the gap widened to more than 12 years. Life expectancy in the Inuit-inhabited areas was generally highest in the Inuvialuit region (Northwest Territories) and Nunavut (Territory), followed by Nunatsiavut (Labrador) and Nunavik (Quebec). While these results are not specific to the Inuit population, such geographic-based methods can be used with any administrative datasets that include postal codes or municipal-level locality codes.

Keywords

Ethnic groups, infant mortality, Northwest Territories, Nunavut, vital statistics

Authors

Russell Wilkins (1-613-951-5305; russell.wilkins@statcan.ca), Sharanjit Uppal and Philippe Finès are with the Health Information and Research Division at Statistics Canada, Ottawa, Ontario, K1A 0T6. Sacha Senécal and Éric Guimond are with the Strategic Research and Analysis Directorate at Indian and Northern Affairs Canada. Rene Dion is with the First Nations and Inuit Health Branch at Health Canada.

According to the 2001 census, 976,000 Canadians (3% of the total population) self-identified as Aboriginal: First Nations (North American Indian), Métis or Inuit. About 5% of the Aboriginal-identity population, numbering more than 45,000, were Inuit. Inuit are descended from Aboriginal people who historically inhabited the Arctic regions of Canada, Alaska, Greenland and Siberia. Most Inuit in Canada now reside in one of four regions: the Inuvialuit region (along the Arctic coast of the Northwest Territories), Nunavut (eastern Arctic territory), Nunavik (northern Quebec), and Nunatsiavut (northern coast of Labrador).

Data on Inuit identity are collected for deaths that occur in Canada's two northern territories—the Northwest Territories and Nunavut—but not for deaths that take place in the provinces. As a result, since one-fifth of deaths to residents of the Northwest Territories and Nunavut occur in the provinces,[1] and 20% of the total Inuit population of Canada (according to self-identification questions on the census) reside in the provinces, basic health indicators such

as life expectancy at birth cannot be estimated for the Inuit using standard data sources and methods.

Previously, life expectancies had been calculated from nominal list data (no longer available) for Inuit in the former Northwest Territories (including what is now Nunavut) and in Nunavik (northern Quebec) for the years 1941-1950 through 1978-1982.[2,3] Life expectancy at birth for Inuit of the former Northwest Territories rose from 29 years in 1941-1950 (38 years less than for Canada overall), to 37 years in 1951-1960 (33 years less), to 51 years in 1963-1966 (21 years less), and to 66 years in 1978-1982 (19 years less).[4] For Inuit in Nunavik, life expectancy in 1984-1988 was 14 years less than for the total population of Quebec.[5]

Life expectancy figures are regularly published for Quebec's Nunavik health region, and since 2000, for the territory of Nunavut, covering the entire population of those areas, including non-Inuit. Results for 2000-2002[6] showed that life expectancy at birth was about 67 years in Nunavik and about 69 years in Nunavut, or approximately 13 and 11 years less than for Canada as a whole at the time. However, the estimates are based on only three years of deaths; earlier results for what is now Nunavut are not available; and no figures have been published for the Inuit-inhabited areas of the Northwest Territories and Labrador.

Consequently, there are currently no national life expectancy estimates for the Inuit component of the Canadian population. To partially fill this data gap, a geographic-based approach was used to obtain life expectancy for all of the Inuit-inhabited areas of Canada over a 15-year period.

Methods

Areas with a relatively high proportion of Inuit residents were identified. Vital statistics death records and census population counts were used to compute life expectancy measures for these areas.

From census questions, Aboriginal groupings can be determined on the basis of ancestry, legal status (in the case of First Nations), or self-identification. The self-identification question was used to select communities for this study. The choice is important in the case of First Nations, but of less consequence for Inuit, since most who report Inuit ancestry also self-identify as Inuit.[7,8]

According to the Aboriginal identity question on the census, most Inuit live in Nunavut, followed by Nunavik, the Inuvialuit region and Nunatsiavut, and in each of these regions, the majority of the population self-identified as Inuit. The corresponding communities of residence can be readily determined on the basis of place-name-based locality codes, which are always included on vital statistics death records. Postal codes, which can also be used to determine these communities, are often missing on death records from Nunavut and the Northwest Territories.

For a given census subdivision, if the observed proportion of residents who self-identified as Inuit identity was equal to or greater than a chosen cut-off, it was included in the list of Inuit-inhabited areas. When two communities shared the same rural postal code, as was the case with Kuujjuarapik (predominately Inuit) and Whapmagoostui (predominately Cree) in northern Quebec, the population of the two communities was combined before calculation of the proportion Inuit, since assignment to the correct census subdivision based on postal code (or postal community name) would be uncertain.

The total Inuit-identity population of Canada (all provinces and territories) was 45,070. The proportion who would be included in this analysis depended on the cut-off chosen (Table 1). Choosing communities that were "at least 33% Inuit" rather than "at least 20% Inuit" did not change the number of Inuit-inhabited communities included (54). "At least 50% Inuit" would exclude North West River, Labrador (35% Inuit), Inuvik, Northwest Territories (36% Inuit), and Kuujjuuarapik/Whapmagoostui, Quebec (37% Inuit), leaving 51 Inuit-inhabited communities. "At least 67% Inuit" would also exclude Iqaluit, Nunavut (59% Inuit) and Aklavik, Northwest Territories (59% Inuit), leaving 49 Inuit-inhabited communities. (The list of communities defined by each of these potential cut-offs was virtually identical in 1991, 1996 and 2001.) In order to include all 54 of the largely Inuit communities (and all communities in

Table 1
Alternate geographic-based definitions of Inuit-inhabited areas: Aboriginal identity of population of census subdivisions† with a high proportion of Inuit residents, Canada, 2001

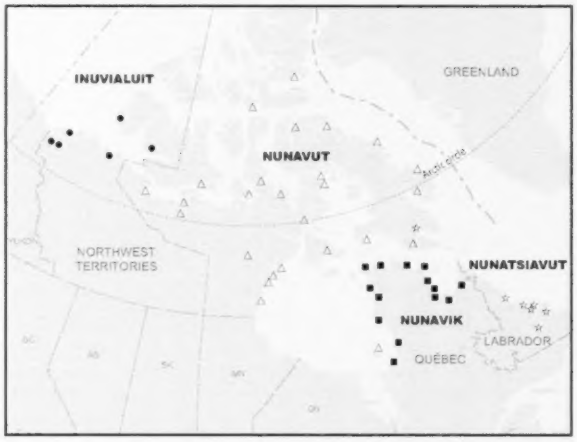
Cut-off	Total population	Aboriginal	Inuit		
			Number	Row %	Column %
No cut-off (all Canada)	29,639,030	976,305	45,070	0.2	100.0
At least 20% Inuit	45,615	38,900	36,450	79.9	80.9
At least 33% Inuit‡	45,615	38,900	36,450	79.9	80.9
At least 50% Inuit	40,880	35,690	34,710	84.9	77.0
At least 67% Inuit	35,055	32,065	31,320	89.4	69.5

† Areas based on complete census subdivisions, except Kuujjuarapik and Whapmagoosui (formerly Great Whale/Poste-de-la-Baleine), Quebec, which share the same postal code and must be combined. Even when municipal codes are assigned from place names, these two communities are not well distinguished; "Great Whale/Poste-de-la-Baleine" has been and may still be used, especially as a mailing address.
‡ used in all remaining tables
Source: 2001 Census of Canada, special tabulations.

the four Inuit land claims settlement areas), the 33% cut-off was selected for this analysis, although the area also includes a larger proportion of non-Inuit (20%: 5% other Aboriginal identity and 15% non-Aboriginal) than would have been the case with more restrictive cut-offs.

The census subdivisions selected were grouped into four regions: the Inuvialuit region (Northwest Territories, 6 communities), Nunavut (the entire territory, 28 communities), Nunavik (Quebec, 14 communities), and Nunatsiavut (Newfoundland and Labrador, 6 communities) (Map 1, Appendix Table A).

Map 1
Inuit-inhabited communities (33% or more Inuit identity), by region, Canada, 2001



Source: Statistics Canada population data; Base map © 2002 Government of Canada with permission from Natural Resources Canada.

Calendar-year deaths were compiled for three 5-year periods: 1989 through 1993, 1994 through 1998, and 1999 through 2003. Person-years at risk were estimated by multiplying by 5 the unadjusted census population counts (100% data, including the institutional population if any) for each mid-period census (1991, 1996 and 2001, respectively). Deaths were compiled based on usual place of residence, regardless of where the death occurred. For example, deaths to Nunavut residents in Ontario or Quebec were assigned to their respective home communities in Nunavut.

Computations were done for males and females, separately and combined. Age was grouped into 19 strata (less than 1, 1-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 65-69, 70-74, 75-79, 80-84, 85 years or more). For each sex and age group, the death rate was calculated as the number of deaths divided by the estimated number of person-years at risk.

Abridged life tables and associated variances, standard errors, and 95% confidence intervals were calculated according to the method of Chiang[9]. The values of Chiang's a (the fraction of the last interval of life lived by those dying in the interval) was set at 0.1 for stratum 1 (to reflect the relatively high mortality in the first year of life) and to 0.5 for all other strata. Ninety-five percent confidence intervals for life expectancy were calculated as the estimate plus or minus 1.96 times its standard error. Ninety-five percent confidence intervals for differences in life expectancy (temporal increases or decreases) were calculated as the difference in life expectancy plus or minus 1.96 times the square root of the sum of the variances for each of the two life expectancies.

Special tabulations of 2001 census data were used to describe the socio-economic characteristics of the population of the Inuit-inhabited areas.

Trends in life expectancy in the Inuit-inhabited areas were compared with life expectancies reported

for all Canada from 1951 to 2001.[10-14] Results for 1999-2003 (2001) were compared with life expectancies reported for other circumpolar regions (Greenland and Alaska), for Canadian First Nations and for other developed and developing countries.[15-18]

Results

Characteristics of the population

The socio-demographic characteristics of the population in the Inuit-inhabited areas differed from those of the total population of Canada (Table 2). In 2001, adults in the Inuit-inhabited areas tended to have less formal education. As well, their employment-to-population ratio was somewhat lower, and while households were larger, household incomes were lower, resulting in much lower average income per person. Finally, the percentage of homes in need of major repairs was three times as high as in Canada overall.

To a large extent, these differences reflected the characteristics of Aboriginal people, particularly the Inuit, in the Inuit-inhabited areas. Among adults,

Table 2
Selected socio-demographic characteristics, all Canada and population groups in the Inuit-inhabited areas, 2001

		Inuit-inhabited areas			
	Canada	Total	Inuit	Other Aboriginal	Non-Aboriginal
Total population (number)	29,639,032	45,615	36,450	2,450	6,720
%	100.0	100.0	100.0	100.0	100.0
Sex					
Male	49.1	51.5	50.9	48.8	55.8
Age (years)					
0 to 14	19.4	36.6	40.3	37.7	16.0
15 to 64	68.4	60.3	56.4	58.0	82.0
65 or older	12.2	3.2	3.3	4.3	2.1
Education†					
Elementary or less	9.8	26.1	32.1	25.9	2.9
Some secondary	21.5	25.3	29.9	23.1	8.3
Secondary graduation	14.1	5.8	4.7	6.5	10.0
Some or completed postsecondary non-university	28.8	30.6	30.1	35.4	31.4
Some university	10.4	4.6	2.3	5.0	13.4
University graduation	15.4	7.6	0.9	4.0	34.1
Employment					
Unemployment rate‡	7.3	16.9	22.4	13.6	3.3
Employment/Population ratio§	70.8	57.8	49.6	55.1	89.3
Occupation††					
Management	10.0	8.9	5.4	9.0	18.9
Professional	15.3	17.4	13.3	11.5	30.4
Skilled	29.6	27.7	27.4	31.0	27.9
Semi-skilled	31.6	24.3	27.0	24.7	16.7
Unskilled	13.4	21.7	27.0	23.8	6.1
Income‡‡					
Average household income ($)	68,000	60,000	54, 000	58,000	91,000
Average household size (number)	3.6	5.1	5.4	4.8	3.7
Average income per person ($)	23,000	15,000	11,000	14,000	36,000
Housing§§					
In need of major repairs	8.3	23.0	24.7	26.1	13.1

† non-institutional population aged 15 or older
‡ non-institutional population aged 15 to 64, active in labour force (CANSIM table 282-0087 for Canada)
§ non-institutional population aged 15 to 64 (CANSIM table 282-0002 for Canada)
†† based on Human Resources Development Canada occupational coding (detailed definition available on request from first author); non-institutional population aged 15 or older who worked in 2001
‡‡ income in 2000, non-institutional population
§§ excluding collective dwellings and band housing
Source: 2001 Census of Canada, special tabulations.

32% of Inuit and 26% of other Aboriginal peoples in these areas had no more than elementary school, compared with just 3% of the non-Aboriginal population. By contrast, only 1% of Inuit and 4% of other Aboriginal peoples had a university degree, compared with 34% of non-Aboriginal people. In the Inuit-inhabited areas, about half of Inuit and other Aboriginal people aged 15 to 64 had a job, compared with nearly 90% of non-Aboriginal people. And among those who were employed, around a quarter of Inuit and other Aboriginal people performed unskilled labour (27% and 24%, respectively), compared with 6% of the non-Aboriginal population. Fewer than one-fifth of employed Inuit and other Aboriginal people, versus almost half the non-Aboriginal group, held professional or managerial positions. And while about a quarter of Inuit and other Aboriginal people lived in homes needing major repairs, this was the case for 13% of non-Aboriginal people in these areas. (For information on progress over time with respect to such socio-economic indicators, see the Inuit social trends series recently published by Indian and Northern Affairs Canada.[19,20] Related information about each community, based on the 2001 Census of Canada, is available as a published document.[21])

The percentage of the population who were Inuit ranged from 54% in the Inuvialuit region, to 68% in Nunatsiavut, and up to 84% in both Nunavut and Nunavik (Table 3).

Table 3
Aboriginal identity of population of the Inuit-inhabited areas, by region, Canada, 2001

Region	Number	Total	Inuit	Other Aboriginal	Non-Aboriginal
			%		
Total	**46,070**	**100.0**	**79.9**	**5.4**	**14.7**
Inuvialuit region	5,225	100.0	54.1	16.9	29.0
Nunavut	26,740	100.0	84.0	0.6	14.8
Nunavik	10,365	100.0	84.0	7.5	8.5
Nunatsiavut	3,740	100.0	68.2	18.9	12.9

Note: Because total is summed from data by sex for 5-year age groups, each independently randomly rounded, it varies from total in Tables 1 and 2.
Source: 2001 Census of Canada, special tabulations.

Population and death data

From 1991 to 2001, the population of the Inuit-inhabited areas increased considerably (Table 4), mainly because of high birth rates among the Inuit and other Aboriginal inhabitants.[22] In 2001, most of the population of the Inuit-inhabited areas resided in Nunavut (58%), followed by Nunavik (23%), the Inuvialuit region (11%), and Nunatsiavut (8%).

Over the 1991 to 2001 period, there were 3,474 deaths to residents of these areas out of a total of 643,275 person-years at risk. During this time, 18% of the deaths to residents of Nunavut and of the

Table 4
Census population counts, person-years at risk and deaths in the Inuit-inhabited areas, by region, Canada, 1991, 1996 and 2001

	All regions	Inuvialuit region	Nunavut	Nunavik	Nunatsiavut
Population[†]					
1991	39,540	5,735	21,255	8,210	4,340
1996	43,045	5,740	24,680	9,285	3,340
2001	46,070	5,225	26,740	10,365	3,740
Person-years at risk[‡]					
1989 to 1993	197,700	28,675	106,275	41,050	21,700
1994 to 1998	215,225	28,700	123,400	46,425	16,700
1999 to 2003	230,350	26,125	133,700	51,825	18,700
Deaths					
1989 to 1993	1,053	120	543	256	134
1994 to 1998	1,133	142	579	285	127
1999 to 2003	1,288	156	642	357	133

† Because populations are summed from data by sex for 5-year age groups, each independently randomly rounded, they vary from total in Tables 1 and 2.
‡ person-years at risk during each 5-year period estimated at 5 times the population at mid-period census
Source: Population data and person-years at risk from special tabulations of 1991, 1996 and 2001 censuses, unadjusted for net undercoverage; deaths from Canadian Mortality Data Base.

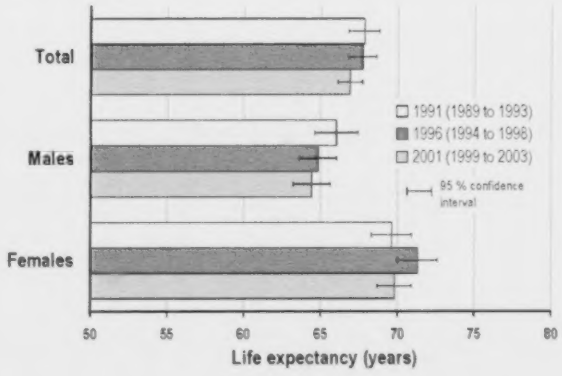
Inuvialuit region occurred outside of those territories, mostly in the adjacent provinces to the south (data not shown). As previously explained, such deaths were included in this analysis, according to the decedents' usual place of residence. Almost all deaths to residents of Nunavik and Nunatsiavut occurred in their respective provinces (Quebec, and Newfoundland and Labrador, respectively).

Life expectancy

In 1991 (1989-1993), life expectancy at birth (both sexes combined) in the Inuit-inhabited areas was about 68 years (95% CI 66.8 to 68.8) (Chart 1, Table 5). By 2001 (1999-2003), life expectancy in these areas had not increased, and may even have declined by about a year (95% CI -2.2 to +0.4). Life expectancy for males may have fallen by more than a year (95% CI -3.5 to +0.3) and was virtually unchanged for females (95% CI -1.5 to +1.9).

However, levels and trends in life expectancy varied by region (Chart 2). In Nunavut, life expectancy may have increased by about a year (95% CI -0.4 to +3.0), although the increase was limited to females, as that of males hardly changed. Life expectancy fell by nearly 4 years (95% CI -6.4 to -1.0) in Nunavik, and possibly, by about 3 years (95% CI -6.3 to +0.5) in the Inuvialuit region.

Chart 1
Life expectancy at birth in the Inuit-inhabited areas, Canada, 1991, 1996 and 2001



Source: Canadian Mortality Data Base; Census of Canada.

In 1991, life expectancy in the Inuit-inhabited areas had been 10 years less than in Canada overall, with a wider gap for females (11 years) than for males (9 years) (Table 6). By 2001, the difference was more than 12 years, and the gap was similar for males and females. At 67 years in 2001, life expectancy in the Inuit-inhabited areas was about what life expectancy had been for all Canada in 1946.

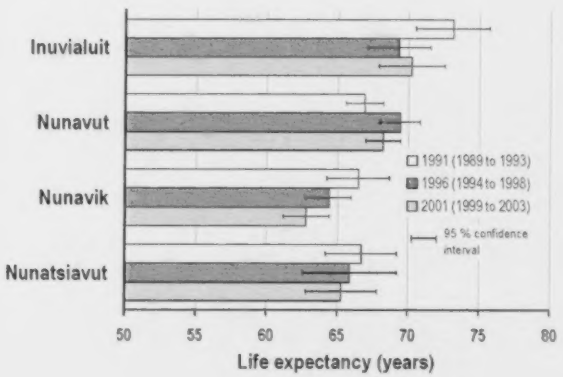
Table 5
Life expectancy at birth in the Inuit-inhabited areas, by sex and region, Canada, 1991, 1996 and 2001

	Total		Inuvialuit region		Nunavut		Nunavik		Nunatsiavut	
	Years	95% confidence interval	Years	95% confidence interval	Years	95% confidence interval	Years	95% confidence interval	Years	95% confidence interval
Both sexes[1]										
1991 (1989 to 1993)	67.8	(66.8 to 68.8)	73.1	(70.5 to 75.7)	66.9	(65.6 to 68.2)	66.5	(64.3 to 68.7)	66.7	(64.2 to 69.2)
1996 (1994 to 1998)	67.7	(66.8 to 68.6)	69.3	(67.1 to 71.5)	69.4	(68.0 to 70.8)	64.4	(62.8 to 66.0)	65.9	(62.6 to 69.2)
2001 (1999 to 2003)	66.9	(66.1 to 67.7)	70.2	(67.9 to 72.5)	68.2	(67.0 to 69.4)	62.8	(61.2 to 64.4)	65.3	(62.8 to 67.8)
Difference, 1991 to 2001	-0.9	(-2.2 to 0.4)	-2.9	(-6.3 to 0.5)	1.3	(-0.4 to 3.0)	-3.7	(-6.4 to -1.0)	-1.4	(-5.0 to 2.2)
Males										
1991 (1989 to 1993)	66.0	(64.6 to 67.4)	68.0	(64.7 to 71.3)	66.8	(64.6 to 69.0)	63.6	(60.6 to 66.6)	64.3	(60.5 to 68.1)
1996 (1994 to 1998)	64.8	(63.6 to 66.0)	66.2	(63.1 to 69.3)	67.2	(65.3 to 69.1)	60.6	(58.5 to 62.7)	60.9	(56.7 to 65.1)
2001 (1999 to 2003)	64.4	(63.2 to 65.6)	68.1	(64.4 to 71.8)	66.4	(64.8 to 68.0)	57.5	(55.4 to 59.6)	62.5	(58.2 to 66.8)
Difference, 1991 to 2001	-1.6	(-3.5 to 0.3)	0.1	(-4.9 to 5.1)	-0.4	(-3.2 to 2.4)	-6.1	(-9.7 to -2.5)	-1.8	(-7.5 to 3.9)
Females										
1991 (1989 to 1993)	69.6	(68.3 to 70.9)	79.2	(74.9 to 83.5)	68.2	(66.5 to 69.9)	69.0	(65.8 to 72.2)	68.5	(65.1 to 71.9)
1996 (1994 to 1998)	71.3	(70.0 to 72.6)	73.1	(69.8 to 76.4)	70.9	(69.0 to 72.8)	69.0	(66.4 to 71.6)	73.4	(68.5 to 78.3)
2001 (1999 to 2003)	69.8	(68.7 to 70.9)	73.1	(70.0 to 76.2)	70.0	(68.3 to 71.7)	67.3	(65.1 to 69.5)	72.2	(67.8 to 76.6)
Difference, 1991 to 2001	0.2	(-1.5 to 1.9)	-6.1	(-11.3 to -0.9)	1.8	(-0.6 to 4.2)	-1.7	(-0.6 to 4.2)	3.7	(-1.8 to 9.2)

[1] calculated from pooled deaths and person-years at risk

Source: Person-years at risk from mid-period census populations; deaths 1989 to 2003 from Canadian Mortality Data Base.

Chart 2
Life expectancy at birth in the Inuit-inhabited areas, by region, Canada, 1991, 1996 and 2001



Source: Canadian Mortality Data Base; Census of Canada.

Table 6
Life expectancy at birth in the Inuit-inhabited areas and all Canada, by sex, selected years

Area/Years	Both sexes	Males	Females
Inuit-inhabited areas			
1991 (1989 to 1993)	67.8	66.0	69.6
1996 (1994 to 1998)	67.7	64.8	71.3
2001 (1999 to 2003)	66.9	64.4	69.8
All Canada			
1926 (1925 to 1927)	61.4	60.5	62.3
1931 (1930 to 1932)	61.0	60.0	62.1
1936 (1935 to 1937)	62.5	61.3	63.7
1941 (1940 to 1942)	64.6	63.0	66.3
1946 (1945 to 1947)	66.7	65.1	68.6
1951 (1950 to 1952)	68.5	66.4	70.9
1956 (1955 to 1957)	70.1	67.7	72.9
1961 (1960 to 1962)	71.1	68.4	74.3
1966 (1965 to 1967)	71.8	68.7	75.3
1971 (1970 to 1972)	72.7	69.4	76.5
1976 (1975 to 1977)	73.8	70.3	77.7
1981 (1980 to 1982)	75.4	71.9	79.1
1986 (1985 to 1987)	76.4	73.0	79.7
1991 (1990 to 1992)	77.8	74.6	80.9
1996 (1995 to 1997)	78.3	75.4	81.2
2001 (2000 to 2002)	79.5	77.0	82.0

Note: All Canada life expectancy for both sexes is a simple average of life expectancies calculated for each sex separately.

Sources: Inuit-inhabited areas: Person-years at risk estimated from mid-period census populations; deaths 1989 to 2003 from Canadian Mortality Data Base.
All Canada: 1926 to 1981 (Nagnur, 1986); 1986 (Statistics Canada, 1991); 1991 (Millar and David, 1995); 1996 (Duchesne et al, 2002); 2001 (Statistics Canada, 2006).

In 2001, life expectancy in Canada's Inuit-inhabited areas was the same as in Greenland, which is largely Inuit-populated[16]; slightly lower than for all Alaskan natives[17] (only 47% of whom are Inuit[23]); and about 6 years less than for Canada's First Nations (Table 7). Life expectancy in other developed countries tended to be considerably higher.[18] Only developing countries had levels of life expectancy similar to those in Canada's Inuit-inhabited areas—for instance, the Dominican Republic, Egypt, and Guatemala,[18] which had much lower Gross Domestic Product (GDP) per capita (about $4,000 to $5,000 in international dollars in 2004) than did Canada (about $31,000).[24]

Infant mortality

The infant mortality rate for the Inuit-inhabited areas fell from 25.6 deaths per 1,000 population younger than age 1 (95% CI 21.6 to 30.3) in 1989-1993, to 21.9 (95% CI 18.2 to 26.4) in 1994-1998, and to 18.5 (95% CI 15.0 to 22.9) in 1999-2003 (data not shown elsewhere). These rates were about four times higher than those for Canada overall: 6.0, 5.2 and 4.8 deaths per 1,000 live births, respectively.[25] Nonetheless, the rate difference between the Inuit-inhabited areas and all Canada fell from 19.6 deaths (95% CI 15.2 to 23.9) to 16.7 deaths (95% CI 12.7 to 20.7) to 13.8 deaths (95% CI 9.9 to 17.6) per 1,000 over those years, a decrease of 5.8 deaths per 1,000, or 30%.

Discussion

Life expectancy in the Inuit-inhabited areas was far below that for the country overall, and considerably below that for other Aboriginal peoples in Canada. As well, while life expectancy in Canada overall continued to rise, it appears to have stagnated in the Inuit-inhabited areas, so the gap widened by more than two years during this period.

The substantial decline in life expectancy in Nunavik during this period is particularly striking. The former extraordinary gains—from 35 years in 1946 (1941-1951) to 61 years in 1976 (1971-1981)[2]—now appear to have stalled, with little if any lasting progress since the mid-1970s.

Table 7
International comparisons of life expectancy at birth, by sex, selected years

	Years	Life expectancy		
		Both sexes	Males	Females
Circumpolar region and First Nations of Canada				
Inuit-inhabited areas of Canada	1991 (1989 to 1993)	68	66	70
	1996 (1994 to 1998)	68	65	71
	2001 (1999 to 2003)	67	64	70
First Nations of Canada	2001 (projected)	73	70	76
Greenland (total population)	2001 (1999 to 2003)	67	64	70
Alaska natives	1996 (1994 to 1998)	69	..	..
Developed countries				
Japan	2001	81	78	85
Canada	2001	79	77	82
Portugal	2001	77	73	80
United States	2001	77	74	80
Mexico	2001	74	72	77
Turkey	2001	69	67	71
Developing countries				
Armenia	2001	70	66	73
Nicaragua	2001	70	67	72
Thailand	2001	69	66	72
Dominican Republic	2001	67	64	71
Egypt	2001	67	65	68
Guatemala	2001	66	64	69
Bangladesh	2001	62	62	62
Pakistan	2001	61	61	61
Gambia	2001	59	56	61
Nepal	2001	58	58	58

Notes: According to the 2000 US census, 47% of Alaska natives were "Eskimo" (Inuit) (Ogunwole, 2002). According to Statistics Greenland, in 2001, 88% of the population of Greenland was born in Greenland (Statbank Greenland, accessed 28 April 2007).
.. not available
Sources: Inuit-inhabited areas from census populations and Canadian Mortality Data Base; Indian and Northern Affairs Canada, 2005; Statistics Greenland, 2003; Alaska Bureau of Statistics, 2000; World Health Organization, 2005.

However, these findings for the Inuit-inhabited areas do not distinguish life expectancy for Inuit from that of non-Inuit. If the life expectancy of the 15% of the population who were non-Aboriginal is assumed to be the same as that for all Canada (79.5 years in 2001),[14] and that of the 5% of the population who were other Aboriginal to be the same as that of all Registered Indians in Canada (72.8 years in 2000),[15,26,27] then, taking into account the relative population sizes of each group, the life expectancy of Inuit-identity residents would have been 64.2 years (95% CI 63.4 to 65.0)—or 2.7 years less (95% CI -3.0 to -1.6) than that of all residents of the Inuit-inhabited areas, and 15 years less than that for Canada as a whole. Also, because the non-Inuit proportion of the population varied considerably by region, the ranking of the regions according to these rough calculations of life expectancy for the Inuit-identity residents would change, putting the two more southern regions on the bottom and the two Arctic regions on top. Under these assumptions, Inuit life expectancy would have been 60.2 years (95% CI 58.6 to 61.8) in Nunavik, 60.6 years (95% CI 58.1 to 63.1) in Nunatsiavut, 64.4 years (95% CI 62.1 to 66.7) in the Inuvialuit region, and 66.2 years (95% CI 65.0 to 67.4) in Nunavut.

Limitations

This study used a geographic-based approach, and hence, the estimates (except those made hypothetically in the preceding Discussion) are for regions rather than for ethnic groups. That seriously limits how the findings may be interpreted, but it also has two useful implications. First, all residents of the Inuit-inhabited areas, regardless of ethnicity, may experience similar isolation and difficulty accessing health care and other services. Second, health care and other services are provided mainly on a geographic as opposed to an ethnic basis, so

the target population of such services is all residents of a particular area.

Annual population estimates corrected for net census undercount are not available for census subdivisions, so uncorrected population counts were used to determine person-years at risk. This would have led to a slight overestimate of mortality rates and a corresponding slight underestimate of life expectancy—by about -0.1 year, to judge by a comparison of life tables for Nunavut calculated for 1999-2003 (data not shown) with those based on corrected population estimates.[6]

In the life table calculations, arbitrary values for Chiang's *a* were used, rather than values published for other populations or values calculated specifically for this population. However, use of a wide range of plausible alternative values had only a slight impact on life expectancy at birth: less than one-tenth of a year (data not shown), which is negligible compared with the typical 95% confidence intervals of roughly plus or minus one year in this study.

Deaths to residents of the Inuit-inhabited areas that occurred outside Canada or the United States are not included in Canadian vital statistics, so a few deaths may have been missed. This limitation also applies to deaths to residents of the rest of Canada.

Few long-term care facilities are located in the Inuit-inhabited areas. Former residents of those areas who moved south for long-term care could have been counted as residents of the south at the time of their death. This could result in an undercount of deaths at advanced ages for the usual residents of the regions considered in this study.

With a cut-off of at least 33% Inuit, 5% of the population of the Inuit-inhabited areas were other Aboriginal, and another 15%, non-Aboriginal. While the other Aboriginal group had socio-economic characteristics similar to those of the Inuit and probably somewhat higher life expectancy, the non-Aboriginal group had much more favourable socio-economic characteristics and probably considerably higher life expectancy. This mixing of high- and low-mortality populations would be expected to reduce overall mortality rates, an effect that might have been apparent had it been possible to confine the study to Inuit rather than to Inuit-inhabited areas.

Summary and conclusion

Areas where at least 33% of residents were Inuit were identified, and census population counts and vital statistics death data were used to calculate life tables for those areas during three five-year periods: 1989 through 1993 (centered around 1991), 1994 through 1998 (1996), and 1999 through 2003 (2001). The population of these areas was 80% Inuit, and included 81% of all Inuit in Canada. In 1991, life expectancy in the Inuit-inhabited areas was approximately 10 years less than for Canada as a whole. And from 1991 to 2001, while life expectancy for Canada overall rose by about two years, it did not increase in the Inuit-inhabited areas (and may have fallen by about a year), further widening the gap.

Analysis of 2001 census data revealed lower levels of education and income, and poorer employment and housing conditions in the Inuit-inhabited areas compared with Canada as a whole, and within the Inuit-inhabited areas, for Inuit compared with the non-Aboriginal population. Any or all of these factors, in addition to others such as lifestyle risk factors and environmental conditions,[28] about which information was not available from death registrations, could be at least partly responsible for the lower life expectancy in the Inuit-inhabited areas. Moreover, although the calculations for these areas are dominated by the life expectancy of Inuit residents, they likely also reflect the presumably higher life expectancies of non-Aboriginal and other Aboriginal residents.

Over the entire study period, the infant mortality rate was approximately four times higher in the Inuit-inhabited areas, compared with all Canada. However, the absolute difference in the rates fell by 30% from 1989-1993 to 1999-2003, indicating considerable progress with respect to this key health indicator, although much remains to be accomplished.

This geographic-based method of identifying areas with a high proportion of Inuit residents could be useful for compiling a broad range of administrative data, including birth registrations, hospital morbidity statistics, and disease registry data. Future extensions of this research will examine

causes of death in the Inuit-inhabited areas, and conceptually similar analyses will be undertaken for areas with a high proportion of First Nations and of Métis people. However, other methods of compiling data relevant to Aboriginal health should be considered, such as data linkages to Aboriginal population registries[29,30] and self-reporting (or reporting by next-of-kin) in vital statistics[31] and other health records. ●

Acknowledgements

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Appendix

Table A
Inuit-inhabited communities and corresponding postal codes and census subdivision (CSD) codes, by region, Canada

CSD 1996	CSD 2001	Postal code	CSD type	CSD name (alternate names, notes)
Inuvialuit region (Northwest Territories) - 6 communities (shown ordered from West to East)				
6107025	6107025	X0E0A0	HAM	Aklavik
6107017	6107017	X0E0T0	T	Inuvik
6107036	6107036	X0E1C0	HAM	Tuktoyatuk (formerly Port Brabant)
6107014	6107014	X0E1N0	SET	Paulatuk
6107041	6107041	X0E0Z0	HAM	Sachs Harbour (Ikahuak)
6108095	6107095	X0E0S0	HAM	Holman (now Ulukhaktok as of 1 April 2006; note change of census division)
Nunavut (entire territory) - 28 communities (shown ordered by CSD 2001)†				
Qikiqtaaluq (formerly Baffin) Region - 14 communities + 1 unorganized area				
6104001	6204001	X0A0W0	HAM	Sanikiluaq
6104003	6204003	X0A1H0/0H0	T	Iqaluit (formerly Frobisher Bay)
6104005	6204005	X0A0N0	HAM	Kimmirut (formerly Lake Harbour)
6104007	6204007	X0A0C0	HAM	Cape Dorset (Kinngait)
6104009	6204009	X0A0R0	HAM	Pangnirtung (Pangniqtuuq)
6104010	6204010	X0A0B0	HAM	Qikiqtarjuaq (formerly Broughton Island)
6104011	6204011	X0A0K0	HAM	Hall Beach (Sanirajak)
6104012	6204012	X0A0L0	HAM	Igloolik (Iglulik)
6104015	6204015	X0A0E0	HAM	Clyde River (Kangiqtugaapik)
6104018	6204018	X0A0A0	HAM	Arctic Bay (Ikpiarjuk)
6104019	6204019	X0A0X0	SET	Nanisivik
6104020	6204020	X0A0S0	HAM	Pond Inlet (Mittimatalik)
6104022	6204022	X0A0V0	HAM	Resolute (Qausuittuq)
6104025	6204025	X0A0J0	HAM	Grise Fiord (Aujuittuq)
6104030	6204030	X0A0G0	UNO	Baffin, Unorganized (Canada Post=Eureka; weather station/military base)
Kivalliq (formerly Keewatin) Region - 7 communities + 1 unorganized area				
6105014	6205014	X0C0C0	HAM	Coral Harbour (Salliq)
6105015	6205015	X0C0E0	HAM	Arviat (formerly Eskimo Point)
6105016	6205016	X0C0J0	HAM	Whale Cove (Tikirarjuaq)
6105017	6205017	X0C0G0	HAM	Rankin Inlet (Kangiqiniq or Kangirliniq)
6105019	6205019	X0C0B0	HAM	Chesterfield Inlet
6105023	6205023	X0C0A0	HAM	Baker Lake (Qamanit'uaq)
6105027	6205027	X0C0H0	HAM	Repulse Bay (Naujaat)
6105033	6205033	******	UNO	Keewatin, Unorganized
Kitikmeot Region - 7 communities + 1 unorganized area				
6108047	6208047	X0B0K0	HAM	Kugaaruk (formerly Pelly Bay)
6108059	6208059	X0B0E0	HAM	Kugluktuk (Qurluqtuq; formerly Coppermine)
6108065	6208065	X0B2A0	SET	Bathurst Inlet (Kingoak)
6108068	6208068	X0B2A0	SET	Umingmaktok (Umingmaktuuq formerly Bay Chimo and still that for Canada Post)
6108073	6208073	X0B0C0	HAM	Cambridge Bay (Iqaluktuuttiaq)
6108081	6208081	X0B1J0	HAM	Gjoa Haven (Uqsuquqtuuq)
6108087	6208087	X0B1B0	HAM	Taloyoak (Talurjuaq; formerly Spence Bay)
6108098	6208098	******	UNO	Kitikmeot, Unorganized
Nunavik (Quebec) - 14 communities (most of which each have two CSD codes)				
Ungava Bay to Hudson Strait - 8 communities (shown ordered from East to West)				
2499090	2499090	J0M1N0	VN	Kangiqsualujjuaq (formerly George River)
2499894	2499894	J0M1N0	TI	Kangiqsualujjuaq
2499095	2499095	J0M1C0	VN	Kuujjuaq (formerly Fort Chimo)
2499893	2499893	J0M1C0	TI	Kuujjuaq
2499100	2499100	J0M1T0	VN	Tasiujaq
2499892	2499892	J0M1T0	TI	Tasiujaq
2499105	2499105	J0M1X0	VN	Aupaluk
2499891	2499891	J0M1X0	TI	Aupaluk
2499110	2499110	J0M1A0	VN	Kangirsuk
2499890	2499890	J0M1A0	TI	Kangirsuk
2499115	2499115	J0M1J0	VN	Quaqtaq (formerly Koartuk)
2499889	2499889	J0M1J0	TI	Quaqtaq

Table A
Inuit-inhabited communities and corresponding postal codes and census subdivision (CSD) codes, by region, Canada continued

CSD 1996	CSD 2001	Postal code	CSD type	CSD name (alternate names, notes)
2499130	2499130	J0M1K0	VN	Kangiqsujuaq (formerly Wakeham Bay)
2499888	2499888	J0M1K0	TI	Kangiqsujuaq (formerly Payne Bay)
2499135	2499135	J0M1S0	VN	Salluit (formerly Sugluk)
2499887	2499887	J0M1S0	TI	Salluit
Hudson Bay coast - 6 communities (shown ordered North to South)				
2499140	2499140	J0M1H0	VN	Ivujuvik
2499125	2499125	J0M1V0	VN	Akulivik
2499883	2499883	J0M1V0	TI	Akulivik
2499120	2499120	J0M1P0	VN	Puvirnituq (formerly Povungnituk, and still that for Canada Post)
2499085	2499085	J0M1M0	VN	Inukjuak (formerly Port Harrison)
2499879	2499879	J0M1M0	TI	Inukjuak
2499080	2499080	J0M1Y0	VN	Umiujaq
2499075	2499075	J0M1G0	VN	Kuujjuarapik (formerly Great Whale / Poste-de-la-Baleine)
2499816	2499816	J0M1G0	TR	Whapmagoostui (formerly Great Whale / Poste-de-la-Baleine)
2499070	2499070	J0M1G0	VC	Whapmagoostui (formerly Great Whale / Poste-de-la-Baleine)
Nunatsiavut (Labrador) - 6 communities and 1 unorganized area (shown ordered North to South)				
1010056	1010056	A0P1L0	T	Nain
1010048	1010048	A0P1G0	T	Hopedale
1010044	1010044	A0P1J0	T	Makkovik
1010059	1010059	A0P1N0	T	Postville
1010042	1010042	******	SUN	Division No. 10 to Subd E (nr Nain, Hopedale, Makkovik, Postville)
1010021	1010021	A0P1P0	T	Rigolet
1010022	1010022	A0P1M0	T	North West River

[1] Nunavut had only rural postal codes. All postal codes beginning with X0A or X0B or X0C are for Nunavut and only Nunavut.

Notes: Census subdivision (CSD) types defined as follows: HAM=Hamlet; T=Town; SET=Settlement; SUN=Subdivision of unorganized area; TI=Terre inuite (Inuit lands); UNO=Unorganized area; VN=Village nordique (Nordic village); VC=Village cri (Cree village). Asterisks in the postal code field means no postal code assigned for this unorganized and essentially unpopulated area. For most of these communities, 1991 and 1996 CSD codes were identical. Exceptions were 1996 CSD 6108095 (Holman) became 2001 CSD 6107095 (now Ulukhaktok), and the first two digits of each CSD in what is now Nunavut changed from "61" in the 1996 CSD to "62" in the 2001 CSD. To use these CSD-based definitions with vital statistics birth, death or stillbirth records, vital statistics geographic codes must first be translated to census standard geographic codes for the nearest census year or 'vintage,' since the vital statistics geographic codes contain various kinds of non-standard codes, including codes specific to vital statistics, inter-censal revised codes, and codes from previous vintages of census standards. Postal codes are shown for reference only, since death data for the northern territories frequently lacked postal codes, so only census subdivision codes (which were always present) were used in the definitions of Inuit-inhabited areas.

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Obesity and the eating habits of the Aboriginal population

Didier Garriguet

Abstract

Objectives

This article compares rates of overweight/obesity and obesity and food consumption patterns of off-reserve Aboriginal and non-Aboriginal people aged 19 to 50 in Ontario and the western provinces.

Data sources

The data are from the 2004 Canadian Community Health Survey: Nutrition (cycle 2.2).

Analytical techniques

Cross-sectional analyses were used to estimate the percentages of individuals who were overweight/obese or obese and average nutrient consumption, based on Aboriginal identity and other selected characteristics. Logistic regression was used to determine the independent influence of Aboriginal identity on overweight/obesity and obesity.

Main results

In 2004, the overweight/obesity and obesity rates of off-reserve Aboriginal people aged 19 to 50 were higher than those of the non-Aboriginal population. These overall differences primarily reflected higher rates of overweight/obesity and obesity among Aboriginal women. At ages 19 to 30, these differences can partly be explained by higher calorie intake by Aboriginal women, despite identical energy needs, based on height, weight, age and physical activity. Most of the excess calories are eaten as snacks and come from "other foods."

Keywords

Aboriginal, nutrition, obesity, physical activity, diet

Author

Didier Garriguet (613-951-7187; didier.garriguet@statcan.ca) is with the Health Information and Research Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

During the past 25 years, the prevalence of obesity in Canada has risen steadily.[1] This increase is part of a global phenomenon that the World Health Organization has described as an epidemic.[2] Obesity is recognized as a risk factor for a variety of serious health problems such as type 2 diabetes and cardiovascular diseases.[2-6]

While the causes of obesity are complex, excess weight is ultimately determined by the difference between energy consumed from food and drinks, and energy expended by an individual's basal metabolism and in daily physical activities. However, other factors—environmental and genetic, for example—can influence daily energy needs and expenditure.[7]

In Canada, the prevalence of overweight and obesity is much higher among Aboriginal people (data are available only for those living off-reserve) than among the rest of the population.[8,9] But high obesity rates among Aboriginal people are not unique to Canada: the same patterns are evident in the United States,[10] Australia,[11] New Zealand,[12] and the Pacific Islands.[13]

With data from the 2004 Canadian Community Health Survey (CCHS): Nutrition, this article analyses differences in overweight and obesity between off-reserve Aboriginal people and the non-Aboriginal population aged 19 to 50. Differences in the dietary habits of the two groups are also examined.

Methods

Data source

The data are from the 2004 Canadian Community Health Survey (CCHS): Nutrition, cycle 2.2. As the name implies, the 2004 CCHS collected information about the dietary habits of Canadians (http://www.statcan.ca/english/concepts/hs). And unlike previous CCHS cycles, rates of overweight and obesity from this cycle are based on direct measurements rather than on self-reports, which tend to be associated with underestimates.[8,14]

The CCHS excludes members of the regular Canadian Forces and people living in the territories, on Indian reserves, in institutions, in some remote regions, and all residents (military and civilian) of Canadian Forces bases. Detailed descriptions of the CCHS design, sample and interview procedures are available in a published report.[15]

Because geographic location can affect nutritional choices, it is important that Aboriginal and non-Aboriginal people be adequately represented in each province. A minimum of 25 adults aged 19 to 50 per province and per sex was needed to ensure minimal representation. But even though a supplementary sample of Aboriginal people was selected for the 2004 CCHS, the national sample of respondents substantially underrepresents Aboriginal people in Quebec and the Atlantic provinces. The sample of 19- to 50-year-olds for Quebec and the Atlantic provinces included only 76 Aboriginal people (Table 1). Consequently, this analysis is confined to Ontario, Manitoba, Saskatchewan, Alberta and British Columbia.

Table 1
Sample size of off-reserve Aboriginal respondents aged 19 to 50, by province and sex, 2004 Canadian Community Health Survey: Nutrition

Province	Sample size	
	Men	Women
Newfoundland and Labrador	9	24
Prince Edward Island	2	0
New Brunswick	9	10
Nova Scotia	3	9
Quebec	5	5
Ontario	26	64
Manitoba	68	117
Saskatchewan	34	33
Alberta	33	41
British Columbia	27	42

Analytical techniques

Descriptive statistics were used to estimate the percentages of people who were overweight/obese or obese by Aboriginal identity, sex, age group, level of leisure-time physical activity, highest level of education in the household, and household income. Logistic regression was used to determine associations between Aboriginal identity, these sociodemographic characteristics and overweight/obesity and obesity. Because of the low response rate (57.5%) for the measured height and weight component of the CCHS, an adjusted survey weight that accounted for non-response was used for the analyses dealing with anthropometric measures. The analyses of overweight/obesity and obesity in this article were based on 3,544 respondents aged 19 to 50 (Aboriginal and non-Aboriginal) for whom measured height and weight data had been collected.

Respondents were asked to list all the foods and drinks they had consumed the previous day (24-hour food recall). A five-step method, based on the *Automated Multiple-Pass Method (AMPM)* [16,17] developed in the United States, was used to maximize their recollection:

- a quick enumeration of the foods;
- questions about specific food categories and frequently forgotten foods;
- questions about the time and type of meal;
- a detailed description of the foods and the quantities consumed;
- a final review.

A total of 35,107 people completed the initial 24-hour food recall. The response rate was 76.5%. This analysis is based on 6,224 respondents aged 19 to 50. Five cases with invalid food intake and 4 cases for which intake was null were excluded, as were pregnant women (108) and women who were breastfeeding (77).

The nutrient profile of the foods and drinks respondents reported having consumed was determined according to the Canadian Nutrient Data File 2001b Supplement of Health Canada.[18] For this analysis, the quantity and percentage of daily calories (when applicable) of each of the following nutrients was examined: alcohol,* vitamin B_{12}, vitamin B_6, Vitamin C, caffeine, calcium, carbohydrates,* cholesterol, folate, vitamin D, total calories, linoleic fatty acid,* monounsaturated fatty acids,* linolenic fatty acid,* polyunsaturated fatty acids,* saturated fatty acids,* fats,* dietary fibre, folic acid, folacin, naturally occurring folate, iron, magnesium, water, niacin, phosphorous, potassium, protein,* vitamin A, riboflavin, sodium, thiamin, zinc. The asterisk (*) indicates that the nutrient was analyzed for both quantity and percentage of calories; for example, fats was analyzed in grams and as a percentage of daily calories.

The foods (basic foods, recipes or ingredients) were classified into one of the four food groups, according to the 1992 publication, *Canada's Food Guide to Healthy Eating for People Four Years Old and Over*[19]—vegetables and fruit, milk products, grain products, and meat and alternatives—or in the "other foods" category. No food was counted twice; for example, if a recipe was classified as "other foods," the recipe rather than the ingredients was used, and vice versa.

Quantities expressed in grams were transformed into servings for vegetables and fruit, milk products and grain products, using the Canadian Nutrient Data File.[18] Quantities for the meat and alternatives group were expressed in terms of cooked meat, with one serving containing 50 to 100 grams of meat. Servings without a defined range (peanut butter, for example) were multiplied by a factor equal to 50 grams of cooked meat.

Descriptive statistics based on the 24-hour food recall were used to estimate average nutrient consumption. The original survey weights were used in order to maximize sample size.

The bootstrap method,[20,21] which accounts for the complex survey design, was used to estimate standard errors, coefficients of variation and confidence intervals. The significance level was set at $p < 0.05$.

Definitions

Ethnicity was determined with the following question: "People living in Canada come from many different cultural and racial backgrounds. Are you:

1. White?"
2. Chinese?"
3. South Asian (e.g., East Indian, Pakistani, Sri Lankan)?"
4. Black?"
5. Filipino?"
6. Latin American?"
7. Southeast Asian (e.g., Cambodian, Indonesian, Laotian, Vietnamese)?"
8. Arab?"
9. West Asian (e.g., Afghan, Iranian)?"
10. Japanese?"
11. Korean?"
12. Aboriginal (North American Indian, Métis or Inuit)?"
13. Other – Specify."

Respondents could indicate more than one category. Category 12 was used to identify off-reserve *Aboriginal* people, including those who also self-identified with another group. The other categories together represented the *non-Aboriginal* population.

The definitions of *overweight* and *obesity* were based on body mass index (BMI), which is calculated by dividing weight in kilograms by height in metres squared. For this analysis, BMI categories for adults were established according to Health Canada guidelines.[22] Respondents whose BMI was equal to or greater than 30 kg/m^2 were considered to be obese, and those whose BMI was greater than or equal to 25kg/m^2 were considered to be overweight (overweight includes obese).

Level of *leisure-time physical activity* was based on total energy expenditure (EE) during leisure time. EE was calculated from the reported frequency and duration of all of a respondent's leisure-time physical activities in the three months before his or her 2004 CCHS interview and the metabolic energy demand (MET value) of each activity, which had been independently established:[23]

EE = $\sum$(Ni*Di*METi / 365 days) where
Ni = number of occasions of activity i in a year,
Di = average duration in hours of activity i, and
METi = a constant value for the metabolic energy cost of activity i.

For this analysis, respondents whose EE was less than 1.5 kilocalories per kilogram per day (KKD) were considered *inactive*, and those with higher EEs were considered *active*.

The highest level of *education* in the household was defined according to whether at least one household member had graduated from secondary school.

Household income was based on the number of people living in the household and total income from all sources during the 12 months before the interview. For this analysis, two groups were defined:

Household income group	People in household	Total household income
Lowest	1 or 2	Less than $10,000
	3 or 4	Less than $15,000
	5 or more	Less than $20,000
Middle or high	1 or 2	$10,000 or more
	3 or 4	$15,000 or more
	5 or more	$20,000 or more

Regular (as opposed to diet) soft drinks and sandwiches were defined using the Bureau of Nutritional Sciences (BNS) groups developed at Health Canada and based on British and American food groups systems. *Regular soft drinks* refers to category 46A, and *sandwiches*, to categories 219, A through F.

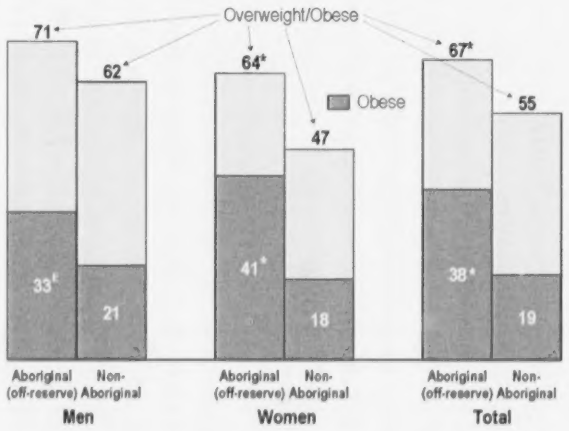
For each food that they had eaten, respondents specified the occasion: breakfast, lunch, dinner, or between-meal consumption. *Between-meal consumption* covers anything that was not reported as breakfast (or brunch), lunch or dinner. It includes snacks, drinks consumed outside of meal, extended consumption (eating or drinking something throughout the day), and other unspecified occasions.

Results

Overweight and obesity

In Ontario and the western provinces, the prevalence of overweight/obesity and obesity among 19- to 50-year-olds was much higher among off-reserve Aboriginal people than among non-Aboriginal people. To a considerable extent, this overall difference reflected higher rates among Aboriginal women; differences between Aboriginal and non-Aboriginal men were not significant (Chart 1).

Chart 1
Percentage overweight/obese (BMI ≥ 25) and obese (BMI ≥ 30), by sex and Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004



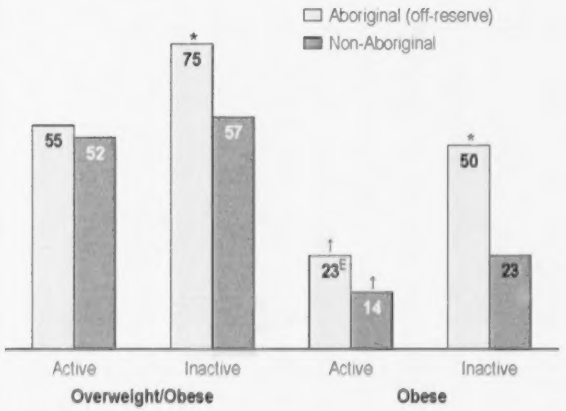
* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
E coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: BMI = body mass index
Source: 2004 Canadian Community Health Survey: Nutrition.

To some extent, these differences may reflect socio-demographic characteristics of Aboriginal and non-Aboriginal people that have previously been shown to be related to excess weight:[8] leisure-time physical activity, education, and income.

A majority—56%— of both Aboriginal and non-Aboriginal 19- to 50-year-olds were "inactive" during their leisure time (data not shown). And whether they were Aboriginal or non-Aboriginal, inactive people had high rates of overweight/obesity and obesity. However, the association seemed to be stronger for the Aboriginal population. Among those who were inactive, 50% of Aboriginal people were obese, compared with 23% of non-Aboriginal people (Chart 2).

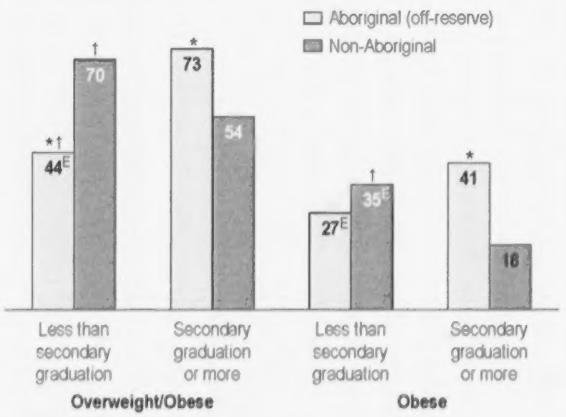
The association between education and excess weight differed for Aboriginal and non-Aboriginal people. Among non-Aboriginal people, excess

Chart 2
Percentage overweight/obese (BMI ≥ 25) or obese (BMI ≥ 30), by leisure-time physical activity and Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004



* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
† significantly different from estimate for "inactive" in same Aboriginal identity group ($p < 0.05$)
E coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: BMI = body mass index
Source: 2004 Canadian Community Health Survey: Nutrition.

Chart 3
Percentage overweight/obese (BMI ≥ 25) or obese (BMI ≥ 30), by highest level of schooling and Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004



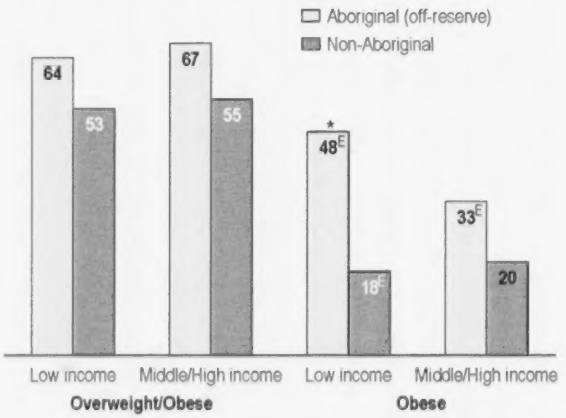
* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
† significantly different from estimate for "secondary graduation or more" in same Aboriginal identity group ($p < 0.05$)
E coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: BMI = body mass index
Source: 2004 Canadian Community Health Survey: Nutrition

weight was more common in households where no member had graduated from high school (Chart 3). By contrast, Aboriginal people in such households were less likely than those living in higher-education households to be overweight/obese. In fact, among residents of lower-education households, Aboriginal people were actually less likely than non-Aboriginal people to be overweight/obese.

Living in a low-income household was associated with a higher rate of obesity for Aboriginal people, but household income was not related to obesity among non-Aboriginal people (Chart 4).

Separate multivariate models for Aboriginal and non-Aboriginal people confirm some of these univariate results (Table 2). Even when the other variables were taken into account, the odds of obesity among people who were inactive in their leisure time, whether they were Aboriginal or non-Aboriginal, were significantly higher than those for active people. The association between household educational attainment and overweight also persisted: among Aboriginal people, the odds of overweight/obesity were significantly lower for

Chart 4
Percentage overweight/obese (BMI ≥ 25) or obese (BMI ≥ 30), by household income and Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004



* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
E coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: BMI = body mass index
Source: 2004 Canadian Community Health Survey: Nutrition.

Table 2
Adjusted odds ratios relating overweight/obesity and obesity to selected characteristics, by Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004

	Overweight/Obesity (BMI ≥ 25)				Obesity (BMI ≥ 30)			
	Aboriginal (off-reserve)		Non-Aboriginal		Aboriginal (off-reserve)		Non-Aboriginal	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Sex								
Men	1.7	0.6 to 4.5	1.9*	1.5 to 2.5	0.9	0.3 to 2.5	1.2	0.9 to 1.7
Women†	1.0	...	1.0	...	1.0	...	1.0	...
Leisure-time physical activity								
Active†	1.0	...	1.0	...	1.0	...	1.0	...
Inactive	2.8*	1.1 to 7.2	1.2	1.0 to 1.6	3.2*	1.3 to 7.7	1.8*	1.3 to 2.4
Education								
Less than secondary graduation	0.3*	0.1 to 0.9	1.9	1.0 to 3.5	0.4	0.1 to 1.4	2.1*	1.1 to 4.0
Secondary graduation or more†	1.0	...	1.0	...	1.0	...	1.0	...
Household income								
Low	0.9	0.3 to 2.6	1.0	0.6 to 1.6	1.7	0.7 to 4.5	0.8	0.5 to 1.5
Middle/High†	1.0	...	1.0	...	1.0	...	1.0	...

† reference category
* significantly different from reference category ($p < 0.05$)
... not applicable
Note: BMI = body mass index
Source: 2004 Canadian Community Health Survey: Nutrition.

Table 3
Adjusted odds ratios relating overweight/obesity and obesity to selected characteristics, household population aged 19 to 50, Ontario and western provinces, 2004

	Overweight/Obesity (BMI ≥ 25)		Obesity (BMI ≥ 30)	
	Adjusted odds ratios	95% confidence interval	Adjusted odds ratios	95% confidence interval
Sex				
Men	1.9*	1.5 to 2.4	1.2	0.9 to 1.6
Women†	1.0	...	1.0	...
Leisure-time physical activity				
Active†	1.0	...	1.0	...
Inactive	1.3	1.0 to 1.6	1.9*	1.4 to 2.5
Education				
Less than secondary graduation	1.6	0.9 to 2.9	1.8	1.0 to 3.5
Secondary graduation or more†	1.0	...	1.0	...
Household income				
Low	1.0	0.6 to 1.5	0.9	0.5 to 1.5
Middle/High†	1.0	...	1.0	...
Aboriginal identity				
Aboriginal (off-reserve)	1.8*	1.1 to 2.9	2.6*	1.5 to 4.3
Non-Aboriginal†	1.0	...	1.0	...

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
... not applicable
Note: BMI = body mass index
Source: 2004 Canadian Community Health Survey: Nutrition.

those in households with a low level of education, whereas non-Aboriginal people in such households had significantly higher odds of obesity. By contrast, the association between excess weight and low household income was no longer significant for Aboriginal people.

Despite the associations between these factors and excess weight, when their effects were controlled, Aboriginal identity emerged as being related to overweight/obesity and obesity among people aged 19 to 50 in Ontario and the western provinces (Table 3). In fact, the odds of obesity were more than two and a half times greater for Aboriginal people.

Calorie consumption

Differences between the average daily calorie intake of Aboriginal and non-Aboriginal people aged 19 to 50 were relatively minor (131 calories more for Aboriginal men; 103 calories more for Aboriginal women) and not statistically significant (Appendix Table A). However, these overall results hide a significant discrepancy among women aged 19 to 30. In this age range, Aboriginal women's average daily intake exceeded that of non-Aboriginal women by 359 calories (Appendix Table B). Yet these

Aboriginal women did not expend more energy or have greater caloric needs, and were not more likely to be active during leisure time (data not shown). The average age of the two groups was the same (24 years), as was their average height (1.64 metres or 5 feet 4.5 inches), and the difference in their average weight (70.3 kilograms or 154.7 pounds for Aboriginal women versus 66.7 kilograms or 146.7 pounds for non-Aboriginal women) accounted for only 37 of the 359 excess calories[24] (data not shown). Therefore, Aboriginal women's higher rates of overweight/obesity and obesity were, in part, associated with higher calorie intake.

Food groups

When the 2004 CCHS was conducted, *Canada's Food Guide to Healthy Eating for People Four Years Old and Over*,[19] which had been prepared in 1992, was in effect. The *Guide* identified four food groups: vegetables and fruit, milk products, grain products, and meat and alternatives. Items not belonging to one of these groups (for example, candy, oils, soft drinks, condiments) were categorized as "other foods." The *Guide* recommended a certain number of servings from each of the four groups, and suggested that consumption of "other foods" be limited.

Table 4
Average daily servings (or grams) from the four food groups, by sex and Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004

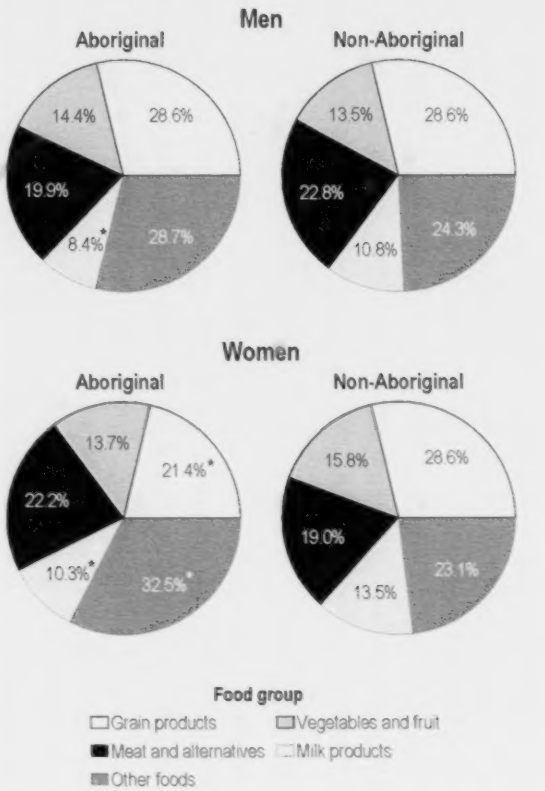
	Aboriginal (off-reserve)		Non-Aboriginal	
	Servings	95% confidence interval	Servings	95% confidence interval
Men				
Grain products	7.3	5.7 to 8.8	6.8	6.5 to 7.1
Vegetables and fruit	4.6	3.2 to 6.1	5.1	4.8 to 5.3
Milk products	1.2*	0.9 to 1.5	1.6	1.5 to 1.7
Meat and alternatives (g)	230	176 to 284	261	248 to 273
Women				
Grain products	3.9*	3.2 to 4.6	4.9	4.7 to 5.1
Vegetables and fruit	3.6*	3.0 to 4.3	4.7	4.5 to 4.9
Milk products	1.3	0.8 to 1.8	1.5	1.4 to 1.6
Meat and alternatives (g)	182	155 to 209	159	152 to 166

* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
Notes: Meats and alternatives are expressed in grams (g) of cooked meat. Excludes pregnant or breastfeeding women.
Source: 2004 Canadian Community Health Survey: Nutrition.

Aboriginal men consumed significantly less milk products than did non-Aboriginal men—about half a serving less per day (Table 4). Among women, those who were Aboriginal had one serving less per day of vegetables and fruit and of grain products than did those who were non-Aboriginal.

The impact of these differences is evident in the share of daily calories coming from the various food groups and from "other foods." Among men, the difference in the proportion of calories derived from milk products was statistically significant (Chart 5). Among women, those who were Aboriginal obtained a smaller percentage of their calories from grain products and from milk products, but a larger

Chart 5
Percentage distribution of sources of calories, by food group, sex and Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004



* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
Source: 2004 Canadian Community Health Survey: Nutrition.

percentage from "other foods." In fact, at ages 19 to 30, "other foods" made up more than 35% of the average daily calories of Aboriginal women, compared with 24% for non-Aboriginal women (data not shown). This difference alone explains 90% of the higher daily caloric intake of Aboriginal women aged 19 to 30.

Soft drinks and sandwiches

An earlier analysis of the 2004 CCHS showed that regular (as opposed to diet) soft drinks were the leading source of calories from "other foods" for the Canadian population overall.[25] Among 19- to 50-year-olds, the soft drink consumption of Aboriginal people significantly exceeded that of non-Aboriginal people. For example, at ages 19 to 30, Aboriginal women averaged 450 grams of regular soft drinks a day, about three times as much as non-Aboriginal women (139 grams) (Table 5).

Table 5
Daily consumption of regular soft drinks, by Aboriginal identity, age group and sex, household population aged 19 to 50, Ontario and western provinces, 2004

	Aboriginal (off-reserve)		Non-Aboriginal	
	Estimate	95% confidence interval	Estimate	95% confidence interval
Ages 19 to 30				
Men				
% of consumers	42.4[E]	24.1 to 60.7	47.0	42.5 to 51.6
Average consumption (g)				
Consumers	961*	712 to 1,211	632	589 to 674
Total aged 19 to 30	408[E]	206 to 609	297	264 to 330
Women				
% of consumers	61.6*	47.4 to 75.8	26.3	22.2 to 30.4
Average consumption (g)				
Consumers	732[E]	488 to 975	529	465 to 594
Total aged 19 to 30	450*[E]	267 to 634	139	113 to 165
Ages 31 to 50				
Men				
% of consumers	56.2*	38.6 to 73.9	29.4	25.7 to 33.0
Average consumption (g)				
Consumers	725	518 to 931	598	534 to 661
Total aged 31 to 50	407*[E]	243 to 572	176	148 to 203
Women				
% of consumers	38.0*[E]	22.7 to 53.2	18.5	15.4 to 21.6
Average consumption (g)				
Consumers	641	452 to 830	473	411 to 536
Total aged 31 to 50	243*[E]	129 to 358	88	70 to 106

* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
[E] coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: Excludes pregnant or breastfeeding women; g = gram.
Source: 2004 Canadian Community Health Survey: Nutrition.

Higher average intake generally reflected a larger proportion of Aboriginal people reporting having consumed soft drinks the day before the interview. When the daily intake of "consumers" was compared, the difference between Aboriginal and non-Aboriginal people was not statistically significant. The exception was men aged 19 to 30: at these ages, Aboriginal and non-Aboriginal men were equally likely to consume soft drinks, but among those who did, Aboriginal men consumed significantly more (961 grams versus 632 grams).

The previous analysis of the eating habits of the total population[25] also found that the "sandwich" category (which includes not only sandwiches per se, but also pizza, submarines, hamburgers and hot dogs) contributed more fat to the Canadian diet than did any other single category. This type of food

Table 6
Daily consumption of pizza, sandwiches, submarines, hamburgers and hot dogs, by Aboriginal identity, age group and sex, household population aged 19 to 50, Ontario and western provinces, 2004

	Aboriginal (off-reserve)		Non-Aboriginal	
	Estimate	95% confidence interval	Estimate	95% confidence interval
Ages 19 to 30				
Men				
Percentage of consumers	67.5	47.7 to 87.2	59.3	54.7 to 63.9
Percentage of calories				
Consumers	29.0	20.5 to 37.5	24.6	23.1 to 26.0
Total aged 19 to 30	20.0[E]	11.5 to 28.5	15.5	14.0 to 16.9
Women				
Percentage of consumers	68.3*	56.3 to 80.4	48.0	43.4 to 52.6
Percentage of calories				
Consumers	24.7	18.6 to 30.8	24.2	22.2 to 26.2
Total aged 19 to 30	18.5*	13.6 to 23.5	12.5	10.9 to 14.0
Ages 31 to 50				
Men				
Percentage of consumers	69.2	54.7 to 83.7	55.3	51.0 to 59.6
Percentage of calories				
Consumers	24.9	20.8 to 29.0	25.2	23.6 to 26.8
Total aged 31 to 50	16.8	11.9 to 21.7	14.8	13.4 to 16.2
Women				
Percentage of consumers	34.8[E]	20.8 to 48.8	40.6	36.6 to 44.6
Percentage of calories				
Consumers	25.9	21.6 to 30.2	23.7	22.1 to 25.3
Total aged 31 to 50	8.5[E]	4.5 to 12.6	10.3	9.1 to 11.5

* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
[E] coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: Excludes pregnant or breastfeeding women.
Source: 2004 Canadian Community Health Survey: Nutrition.

was also a popular choice for Aboriginal people aged 19 to 50. However, differences in consumption between Aboriginal and non-Aboriginal people were significant only for women aged 19 to 30 (Table 6). Aboriginal women in this age range were more likely to have consumed "sandwiches" the day before their CCHS interview (68% versus with 48%) and derived a greater share of their calories from such foods (19% versus 13%). But if only consumers are considered, the proportion of calories was the same.

Snacks

A closer examination of women's eating habits also shows a significant difference in between-meal food consumption. At ages 19 to 30, Aboriginal women got 36% of their daily calories between meals, compared with 28% of calories for non-Aboriginal women (data not shown). The pattern was similar at ages 31 to 50, with Aboriginal women deriving 28% of their calories from snacks, compared with 24% for non-Aboriginal women. No significant differences in between-meal calorie intake were evident among men (data not shown).

Aboriginal and non-Aboriginal women aged 19 to 30 also differed in their choice of snacks. "Other foods" accounted for 63% of the calories consumed between meals by Aboriginal women in this age range, compared with 43% of the calories of their non-Aboriginal contemporaries.

Macronutrients and nutrients

A balanced diet requires adequate, but not excessive, intake of "macronutrients" (fats, carbohydrates and proteins) and "nutrients" (vitamins and minerals).[24]

Overall, Aboriginal men derived a lower percentage of their calories from protein and consumed less calcium and vitamin A than did non-Aboriginal men (Table A). However, the significant differences in calories from protein and in calcium consumption reflected the dietary choices of men aged 19 to 30 (Table B). As well, at ages 19 to 30, Aboriginal men consumed less riboflavin than did non-Aboriginal men. By contrast, the macronutrient and nutrient consumption of Aboriginal and non-Aboriginal men aged 31 to 50 did not differ significantly (Table C).

As noted above, the excess calories consumed by Aboriginal women aged 19 to 30 were mainly attributable to "other foods." These foods tend to be high in fat, sugar and salt. And indeed, significant differences in the consumption of fat and sodium were evident between Aboriginal and non-Aboriginal women in this age range (Table B). As well, carbohydrate consumption and the proportion of calories derived from carbohydrates were higher among Aboriginal women. Aboriginal women aged 19 to 30 derived fewer calories from proteins, but consumed more grams of fat, than did non-Aboriginal women.

At ages 31 to 50, Aboriginal women consumed less fibre, magnesium, vitamin A, folic acid, naturally occurring folic acid and dietary folate equivalent than did non-Aboriginal women (Table C).

Discussion

Conclusion

This analysis of data from the 2004 Canadian Community Health Survey shows that off-reserve Aboriginal people aged 19 to 50 in Ontario and the western provinces had significantly higher rates of overweight/obesity and obesity than did non-Aboriginal people. A similar discrepancy between Aboriginal and non-Aboriginal people was reported in an earlier study using 2004 CCHS data to examine the entire adult population aged 18 or older.[8] Moreover, analyses of self-reported data from the 2001 and 2003 CCHS showed higher rates of overweight and obesity among Aboriginal people than among any other ethnic group.[9]

However, in this study, the relationships between sociodemographic factors and obesity among Aboriginal people were not necessarily the same as those reported for the total population in previous analyses. Inactive leisure time was associated with excess weight for the total adult population[8] and also for Aboriginal people. But while the proportions reporting inactivity were the same, the consequences seemed somewhat stronger for Aboriginal people.

Low educational attainment has been related to obesity for adults overall,[8] but for Aboriginal people,

excess weight tended to be more common among those in households where the level of education was relatively high. As well, for the total adult population, low household income has been linked to lower rates of overweight and obesity,[8] but the trend was the opposite for Aboriginal people—those in lower-income households were more likely to be obese. Nonetheless, as was found in the earlier study based on self-reported data,[9] when sex, physical activity, education and household income were taken into account, Aboriginal identity remained significantly associated with overweight/obesity and obesity.

In this study, the overall differences in overweight/obesity and obesity between the Aboriginal and non-Aboriginal populations were largely attributable to Aboriginal women, specifically those aged 19 to 30. Despite identical energy needs, they consumed more calories than did non-Aboriginal women, mainly foods not belonging to one of the four food groups in the *Food Guide*.[19] Much of the consumption of these "other foods," as was noted in an earlier report,[25] occurred between meals as snacks. "Other foods" also explain differences in carbohydrate, fat and sodium intake between Aboriginal and non-Aboriginal women in this age range.

Links between obesity among Aboriginal women aged 19 to 30 and their high consumption of fat are not unexpected. However, several other dietary patterns among Aboriginal people may be related to obesity. Higher protein consumption has been associated with lower rates of abdominal obesity,[26] but Aboriginal men consumed less protein than did non-Aboriginal men. High fibre consumption, too, has been associated with lower levels of obesity,[26] and Aboriginal women consumed significantly less than did non-Aboriginal women. And although it is not directly related to excess weight, overconsumption of sodium, which was common among Aboriginal women aged 19 to 30, has been associated with an increased risk of hypertension.[27]

Nonetheless, there were many similarities between the health-related characteristics of the Aboriginal and non-Aboriginal populations in Ontario and the western provinces. As was the case for Canadians overall,[25] many Aboriginal people did not follow the recommendations of the *Food Guide*. For example, a substantial percentage do not consume the suggested number of servings of vegetables and fruit, grain products, and milk products.

Further study may be needed to determine whether recommendations for the total population are appropriate for Aboriginal people living off-reserve. Other factors, environmental or genetic, for example, could influence rates of overweight and obesity in the Aboriginal population.

Limitations

For various reasons, the weight and height of many respondents to the 2004 CCHS could not be measured directly. Although this non-response was taken into account, the estimates could still be biased if the characteristics of respondents who were not measured differed systematically from those of respondents from whom direct measurements were obtained.

Reliance on body mass index (BMI) to identify overweight and obesity is problematic. BMI is a good measure at the population level, but not necessarily for individuals. It may misclassify young adults who are still growing, people who are very thin, very muscular, very heavy or very small, and some ethnic or racial groups.[9] BMI cannot assess the distribution of fatty tissue, notably excess abdominal fat, which is associated with increased health risks.[22] And because of the small sample size, people who were classified as overweight (BMI 25.0 to 29.9), but not obese, could not be examined separately in this analysis.

Respondents' leisure-time activities pertained only to the three months before the CCHS interview, and it is possible that these results were subject to recall errors. As well, leisure-time does not reflect an individual's total physical activity; activity at work, at school or for transportation (for example, bicycling) was not considered in this analysis.

The nutrition data are self-reported, and respondents may not recall exactly what they ate or how much. To minimize recall errors, the 2004 CCHS used the five-step multiple-pass method.[16,17] Under controlled conditions, this method has

effectively assessed average calorie intake.[28,29] However, under other conditions, some studies have found under-reporting,[30-32] and others, over-reporting.[33-35]

Despite efforts to ensure an equitable representation of days of the week during data collection, some days could be under-represented. This could affect the results for average dietary intake.

The results for Aboriginal people indicate a high prevalence of overweight/obesity and obesity. However, the data pertain only to the off-reserve population in Ontario and the western provinces.

As well, the small sample size precluded separate analyses of specific Aboriginal groups (North American Indians, Métis and Inuit).

Because the CCHS is a cross-sectional survey, no cause-and-effect relations between obesity and health-related behaviour or other factors can be inferred.

As well, the term "cultural and racial background" in the CCHS questionnaire may have been a source of confusion for some respondents.[36]

More information about the limitations of the survey is available in *Canadian Community Health Survey (CCHS) Cycle 2.2, Nutrition Focus, A Guide to Accessing and Interpreting the Data*, published by Health Canada (http://www.hc-sc.gc.ca/fn-an/surveill/nutrition/commun/index_f.html).

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Appendix

Table A
Average daily nutrient intake, by sex and Aboriginal identity, household population aged 19 to 50, Ontario and western provinces, 2004

	Men				Women			
	Aboriginal (off-reserve)		Non-Aboriginal		Aboriginal (off-reserve)		Non-Aboriginal	
	Average intake	95% confidence interval	Average intake	95% confidence interval	Average intake	95% confidence interval	Average intake	95% confidence interval
Energy (kilocalories)	2,652	2,389 to 2,915	2,521	2,452 to 2,590	1,913	1,711 to 2,115	1,810	1,762 to 1,858
Carbohydrates (g)	333	293 to 372	305	296 to 314	237	211 to 264	226	220 to 233
% of calories	49.9	46.7 to 53.1	48.4	47.7 to 49.2	49.4	47.2 to 51.6	50.0	49.3 to 50.8
Proteins (g)	99	81 to 118	105	102 to 109	73	63 to 82	73	71 to 75
% of calories	14.2*	12.5 to 16.0	16.8	16.4 to 17.2	15.5	13.9 to 17.1	16.3	15.9 to 16.7
Fats (g)	93.1	79.9 to 106.3	90.6	87.2 to 94.1	71.6	61.6 to 81.5	66.0	63.5 to 68.5
% of calories	30.3	27.2 to 33.4	31.0	30.4 to 31.7	32.2	30.6 to 33.9	31.4	30.8 to 32.0
Monounsaturated fats (g)	39.5	33.4 to 45.6	37.2	35.6 to 38.7	29.1	25.2 to 33.1	26.4	25.3 to 27.5
% of calories	12.7	11.2 to 14.2	12.6	12.3 to 13.0	13.0	12.2 to 13.8	12.5	12.2 to 12.7
Polyunsaturated fats (g)	17.0	13.8 to 20.3	16.2	15.4 to 17.0	12.4	10.6 to 14.2	12.0	11.5 to 12.5
% of calories	5.4	4.5 to 6.3	5.5	5.3 to 5.7	5.5	5.1 to 6.0	5.7	5.5 to 5.8
Saturated fats (g)	28.6	24.4 to 32.8	28.6	27.4 to 29.8	23.2	18.9 to 27.6	21.3	20.4 to 22.1
% of calories	9.5	8.5 to 10.5	9.9	9.6 to 10.1	10.4	9.4 to 11.3	10.2	9.9 to 10.4
Linoleic acid (g)	14.0	11.3 to 16.7	13.0	12.4 to 13.7	9.9	8.4 to 11.4	9.5	9.1 to 9.9
% of calories	4.4	3.7 to 5.2	4.4	4.3 to 4.6	4.4	4.0 to 4.8	4.5	4.3 to 4.6
Linolenic acid (g)	2.4	1.8 to 3.1	2.3	2.0 to 2.5	1.7	1.4 to 2.0	1.7	1.6 to 1.8
% of calories	0.8	0.6 to 0.9	0.7	0.7 to 0.8	0.8	0.7 to 0.9	0.8	0.8 to 0.8
Dietary fibre (g)	17.8	14.9 to 20.7	19.2	18.4 to 19.9	13.1*	11.2 to 14.9	15.2	14.6 to 15.9
Sodium (mg)	3,798	3,224 to 4,372	3,611	3,473 to 3,749	2,807	2,511 to 3,103	2,702	2,603 to 2,801
Water (g)	3,339	2,988 to 3,690	3,116	3,033 to 3,198	2,895	2,611 to 3,179	2,754	2,673 to 2,835
Caffeine (mg)	293	201 to 384	255	238 to 272	243	195 to 291	201	187 to 215
Vitamin A to retinol activity equivalent (mcg)	535*	431 to 639	662	620 to 704	496	400 to 591	596	561 to 630
Vitamin B_6 (mg)	2.0	1.8 to 2.3	2.2	2.2 to 2.3	1.5	1.3 to 1.7	1.6	1.6 to 1.6
Vitamin B_{12} (mcg)	4.5	3.5 to 5.4	5.3	4.9 to 5.8	3.3	2.6 to 4.1	3.6	3.2 to 4.1
Riboflavin (mg)	2.1	1.8 to 2.3	2.2	2.2 to 2.3	1.6	1.4 to 1.9	1.7	1.6 to 1.7
Thiamine (mg)	2.1	1.7 to 2.5	2.0	2.0 to 2.1	1.4	1.2 to 1.5	1.4	1.4 to 1.5
Niacin (mg)	46.8	38.8 to 54.8	48.5	46.9 to 50.1	33.5	29.8 to 37.1	33.8	32.8 to 34.7
Vitamin C (mg)	151[E]	98 to 203	131	123 to 139	113	90 to 136	117	112 to 123
Calcium (mg)	801*	695 to 908	950	910 to 989	742	555 to 928	806	775 to 836
Cholesterol (mg)	343	253 to 434	341	321 to 362	273	207 to 340	237	224 to 251
Dietary folate equivalent (mcg)	545	454 to 637	531	510 to 552	375	329 to 422	405	390 to 419
Vitamin D (mcg)	5.4	4.3 to 6.5	5.7	5.4 to 6.1	4.8	3.3 to 6.3	4.6	4.4 to 4.9
Folic acid (mcg)	185	127 to 243	159	150 to 169	93	71 to 115	109	103 to 115
Naturally occurring folate (mcg)	245	207 to 282	259	250 to 269	185*	156 to 214	216	206 to 226
Total folacin (mcg)	433	368 to 499	425	410 to 440	285*	247 to 323	330	319 to 342
Iron (mg)	16.8	14.0 to 19.5	16.7	16.1 to 17.2	11.6	10.3 to 12.9	12.1	11.7 to 12.4
Magnesium (mcg)	350	309 to 391	372	361 to 384	262*	232 to 292	294	286 to 302
Phosphorus (mg)	1,514	1,332 to 1,696	1,566	1,517 to 1,616	1,151	986 to 1,316	1,183	1,150 to 1,216
Potassium (mg)	3,418	2,849 to 3,987	3,463	3,359 to 3,566	2,539	2,263 to 2,816	2,738	2,667 to 2,808
Zinc (mg)	14.2	11.0 to 17.4	14.0	13.4 to 14.5	9.5	8.3 to 10.6	9.6	9.3 to 9.9

* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
[E] coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: Excludes pregnant or breastfeeding women; g = gram; mg = milligram; mcg = microgram.
Source: 2004 Canadian Community Health Survey: Nutrition.

Table B
Average daily nutrient intake, by sex and Aboriginal identity, household population aged 19 to 30, Ontario and western provinces, 2004

	Men				Women			
	Aboriginal (off-reserve)		Non-Aboriginal		Aboriginal (off-reserve)		Non-Aboriginal	
	Average intake	95% confidence interval	Average intake	95% confidence interval	Average intake	95% confidence interval	Average intake	95% confidence interval
Energy (kilocalories)	2,673	2,296 to 3,049	2,665	2,556 to 2,774	2,176*	1,886 to 2,467	1,817	1,743 to 1,890
Carbohydrates (g)	355	286 to 423	328	315 to 342	295*	252 to 338	236	226 to 245
% of calories	52.6	47.5 to 57.8	49.8	48.7 to 50.8	54.2*	52.1 to 56.3	51.9	50.8 to 52.9
Proteins (g)	91*	75 to 106	107	102 to 113	74	62 to 86	71	67 to 74
% of calories	13.5*	12.0 to 15.0	16.1	15.6 to 16.7	13.5*	12.2 to 14.8	15.8	15.3 to 16.3
Fats (g)	89.7	70.4 to 109.0	94.9	89.6 to 100.3	76.0*	65.2 to 86.8	63.1	59.7 to 66.6
% of calories	29.2	24.7 to 33.7	30.8	29.9 to 31.6	30.5	28.6 to 32.4	30.2	29.3 to 31.1
Monounsaturated fats (g)	38.7	28.8 to 48.6	39.3	36.8 to 41.7	31.3*	26.7 to 35.9	24.9	23.5 to 26.4
% of calories	12.3	10.1 to 14.5	12.6	12.2 to 13.0	12.6	11.6 to 13.5	11.9	11.4 to 12.3
Polyunsaturated fats (g)	16.3	11.7 to 20.9	16.9	15.8 to 18.1	14.3*	11.4 to 17.2	11.2	10.4 to 11.9
% of calories	5.1	4.0 to 6.2	5.5	5.2 to 5.7	5.6	4.9 to 6.4	5.3	5.1 to 5.6
Saturated fats (g)	26.7	21.4 to 32.1	29.9	28.1 to 31.6	23.2	19.3 to 27.0	21.0	19.6 to 22.3
% of calories	9.2	7.4 to 11.0	9.8	9.4 to 10.2	9.3	8.2 to 10.4	10.0	9.6 to 10.4
Linoleic acid (g)	13.0	9.7 to 16.4	13.7	12.8 to 14.6	11.5*	9.2 to 13.8	9.0	8.3 to 9.6
% of calories	4.1	3.3 to 4.9	4.4	4.2 to 4.6	4.5	3.9 to 5.1	4.2	4.0 to 4.4
Linolenic acid (g)	2.7[E]	1.5 to 3.9	2.4	2.2 to 2.6	1.9	1.5 to 2.4	1.5	1.4 to 1.6
% of calories	0.8[E]	0.5 to 1.1	0.8	0.7 to 0.8	0.8	0.6 to 0.9	0.7	0.7 to 0.7
Dietary fibre (g)	17.9	13.2 to 22.5	19.1	18.1 to 20.1	13.5	10.9 to 16.2	13.9	13.1 to 14.6
Sodium (mg)	3,681	2,810 to 4,552	3,884	3,665 to 4,103	3,226*	2,750 to 3,702	2,617	2,481 to 2,753
Caffeine (mg)	222[E]	92 to 352	176	155 to 198	194[E]	129 to 258	144	127 to 162
Vitamin A to retinol activity equivalent (mcg)	546	397 to 696	683	616 to 749	511	357 to 664	531	492 to 570
Vitamin B_6 (mg)	2.0	1.7 to 2.4	2.3	2.2 to 2.4	1.5	1.2 to 1.7	1.5	1.5 to 1.6
Vitamin B_{12} (mcg)	4.3	3.1 to 5.5	5.4	4.7 to 6.1	3.0	2.4 to 3.7	3.4	2.8 to 4.0
Riboflavin (mg)	2.0*	1.7 to 2.3	2.3	2.2 to 2.4	1.8	1.5 to 2.2	1.7	1.6 to 1.7
Thiamine (mg)	1.9	1.5 to 2.4	2.1	2.0 to 2.2	1.5	1.3 to 1.7	1.4	1.3 to 1.5
Niacin (mg)	43.1	35.3 to 50.9	49.7	47.3 to 52.1	34.8	29.5 to 40.1	32.3	30.7 to 33.9
Vitamin C (mg)	168[E]	99 to 237	146	131 to 160	142[E]	95 to 190	126	116 to 136
Calcium (mg)	847*	696 to 998	1,047	983 to 1,111	883	668 to 1,098	826	775 to 877
Cholesterol (mg)	293	226 to 359	348	324 to 372	210	172 to 248	209	195 to 222
Dietary folate equivalent (mcg)	593	400 to 787	565	535 to 596	438	365 to 510	387	368 to 406
Vitamin D (mcg)	5.3	3.9 to 6.6	6.0	5.4 to 6.5	4.6[E]	3.0 to 6.3	4.4	4.0 to 4.8
Folic acid (mcg)	215[E]	101 to 329	177	160 to 193	117	91 to 142	110	103 to 118
Naturally occurring folate (mcg)	252	188 to 315	265	248 to 282	194	135 to 253	199	187 to 211
Total folacin (mcg)	467	348 to 586	448	421 to 474	319	254 to 384	315	300 to 330
Iron (mg)	16.0	12.6 to 19.4	17.3	16.5 to 18.1	12.9	11.0 to 14.9	11.8	11.3 to 12.4
Magnesium (mcg)	353	292 to 414	373	356 to 390	271	226 to 316	275	263 to 288
Water (g)	3,451	2,782 to 4,121	3,157	3,034 to 3,281	2,824	2,405 to 3,244	2,558	2,453 to 2,662
Phosphorus (mg)	1,479	1,270 to 1,688	1,625	1,556 to 1,694	1,230	1,022 to 1,438	1,150	1,099 to 1,201
Potassium (mg)	3,282	2,635 to 3,929	3,445	3,286 to 3,603	2,647	2,136 to 3,159	2,573	2,462 to 2,685
Zinc (mg)	13.0	10.5 to 15.4	14.2	13.5 to 15.0	9.7	8.2 to 11.1	9.3	8.8 to 9.8

* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
[E] coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: Excludes pregnant or breastfeeding women; g = gram; mg = milligram; mcg = microgram.
Source: 2004 Canadian Community Health Survey: Nutrition.

Table C
Average daily nutrient intake, by sex and Aboriginal identity, household population aged 31 to 50, Ontario and western provinces, 2004

	Men				Women			
	Aboriginal (off-reserve)		Non-Aboriginal		Aboriginal (off-reserve)		Non-Aboriginal	
	Average intake	95% confidence interval	Average intake	95% confidence interval	Average intake	95% confidence interval	Average intake	95% confidence interval
Energy (kilocalories)	2,638	2,265 to 3,011	2,444	2,358 to 2,531	1,734	1,462 to 2,007	1,807	1,747 to 1,867
Carbohydrates (g)	317	271 to 364	293	281 to 304	198	170 to 226	222	214 to 230
% of calories	48.0	43.9 to 52.1	47.7	46.7 to 48.8	46.2	43.3 to 49.1	49.1	48.1 to 50.2
Proteins (g)	105	77 to 134	104	99 to 109	72	57 to 86	74	71 to 76
% of calories	14.8	12.2 to 17.3	17.2	16.6 to 17.8	16.9	14.6 to 19.2	16.5	16.0 to 17.0
Fats (g)	95.5	77.5 to 113.6	88.3	83.9 to 92.7	68.6	53.1 to 84.0	67.3	64.0 to 70.7
% of calories	31.1	26.9 to 35.2	31.1	30.3 to 32.0	33.4	31.1 to 35.7	32.0	31.2 to 32.8
Monounsaturated fats (g)	40.0	32.2 to 47.9	36.0	34.1 to 38.0	27.7	21.8 to 33.6	27.0	25.6 to 28.5
% of calories	13.0	11.1 to 15.0	12.6	12.2 to 13.1	13.3	12.2 to 14.4	12.7	12.4 to 13.1
Polyunsaturated fats (g)	17.6	13.1 to 22.1	15.8	14.8 to 16.8	11.1	8.8 to 13.3	12.4	11.7 to 13.1
% of calories	5.6	4.3 to 6.9	5.5	5.3 to 5.7	5.5	4.9 to 6.0	5.8	5.6 to 6.0
Saturated fats (g)	29.9	23.9 to 35.9	27.9	26.4 to 29.4	23.3	16.4 to 30.2	21.4	20.2 to 22.5
% of calories	9.8	8.6 to 10.9	9.9	9.6 to 10.2	11.1	9.8 to 12.4	10.2	9.9 to 10.6
Linoleic acid (g)	14.7	10.7 to 18.7	12.7	11.8 to 13.5	8.8	6.9 to 10.8	9.7	9.2 to 10.2
% of calories	4.7	3.6 to 5.8	4.4	4.2 to 4.6	4.3	3.8 to 4.9	4.6	4.4 to 4.8
Linolenic acid (g)	2.3	1.7 to 2.9	2.2	1.9 to 2.5	1.5	1.2 to 1.9	1.8	1.7 to 2.0
% of calories	0.7	0.5 to 0.9	0.7	0.7 to 0.8	0.8	0.6 to 0.9	0.8	0.8 to 0.9
Dietary fibre (g)	17.7	13.8 to 21.6	19.2	18.2 to 20.2	12.7*	10.2 to 15.3	15.9	15.0 to 16.8
Sodium (mg)	3,880	3,104 to 4,656	3,466	3,297 to 3,634	2,522	2,137 to 2,908	2,742	2,610 to 2,874
Caffeine (mg)	342[E]	223 to 460	296	273 to 319	276	205 to 347	228	210 to 247
Vitamin A to retinol activity equivalent (mcg)	527	383 to 671	651	600 to 703	486*	355 to 616	626	579 to 673
Vitamin B_6 (mg)	2.0	1.7 to 2.3	2.2	2.1 to 2.3	1.5	1.3 to 1.8	1.6	1.6 to 1.7
Vitamin B_{12} (mcg)	4.6	3.2 to 6.1	5.3	4.7 to 5.8	3.6[E]	2.3 to 4.8	3.8	3.2 to 4.3
Riboflavin (mg)	2.1	1.7 to 2.5	2.2	2.1 to 2.3	1.5	1.2 to 1.8	1.7	1.6 to 1.8
Thiamine (mg)	2.2	1.6 to 2.7	2.0	1.9 to 2.1	1.2	1.0 to 1.5	1.4	1.4 to 1.5
Niacin (mg)	49.3	37.3 to 61.4	47.9	45.8 to 50.0	32.5	27.5 to 37.6	34.5	33.3 to 35.6
Vitamin C (mg)	139[E]	62 to 215	124	114 to 134	93	73 to 113	113	106 to 120
Calcium (mg)	769	619 to 919	898	851 to 945	646[E]	369 to 923	796	757 to 835
Cholesterol (mg)	379[E]	239 to 519	338	310 to 366	316[E]	212 to 420	251	233 to 269
Dietary folate equivalent (mcg)	512	432 to 592	513	486 to 539	333*	275 to 391	413	394 to 432
Vitamin D (mcg)	5.4	3.8 to 7.1	5.6	5.1 to 6.1	4.9[E]	2.7 to 7.1	4.7	4.4 to 5.1
Folic acid (mcg)	164[E]	108 to 221	150	139 to 161	77[E]	45 to 110	108	100 to 116
Naturally occurring folate (mcg)	240	188 to 291	256	245 to 268	179*	153 to 206	224	212 to 236
Total folacin (mcg)	410	332 to 488	413	394 to 431	262*	218 to 306	338	323 to 352
Iron (mg)	17.3	13.4 to 21.2	16.3	15.6 to 17.0	10.7	9.0 to 12.3	12.2	11.7 to 12.7
Magnesium (mcg)	348	291 to 406	372	358 to 387	256*	215 to 297	303	293 to 314
Water (g)	3,260	2,875 to 3,645	3,093	2,987 to 3,200	2,943	2,530 to 3,357	2,847	2,737 to 2,956
Phosphorus (mg)	1,538	1,261 to 1,815	1,535	1,470 to 1,600	1,097	848 to 1,346	1,199	1,157 to 1,240
Potassium (mg)	3,514	2,649 to 4,378	3,472	3,341 to 3,604	2,466	2,115 to 2,817	2,816	2,729 to 2,902
Zinc (mg)	15.1[E]	10.1 to 20.0	13.9	13.1 to 14.6	9.4	7.7 to 11.0	9.8	9.4 to 10.2

* significantly different from corresponding estimate for non-Aboriginal ($p < 0.05$)
[E] coefficient of variation 16.6% to 33.3% (interpret with caution)
Note: Excludes pregnant or breastfeeding women; g = gram; mg = milligram; mcg = microgram
Source: 2004 Canadian Community Health Survey: Nutrition.

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Chronic pain in Canadian seniors

Pamela L. Ramage-Morin

Abstract

Objectives

This study describes the prevalence of chronic pain among seniors living in private households and in long-term health care institutions. Associations between an increase in chronic pain and unhappiness and negative self-perceived health are examined.

Data sources

Data are from the Health Institutions and Household components of Statistics Canada's 1994/1995 through 2002/2003 National Population Health Survey (NPHS) and 2005 Canadian Community Health Survey (CCHS).

Analytical techniques

Prevalence rates of chronic pain were estimated using cross-sectional data from the 1996/1997 NPHS and the 2005 CCHS. Multiple logistic regression was used to model an increase in chronic pain in relation to quality of life outcomes, controlling for chronic conditions, medication use, age, sex, proxy response, and socioeconomic status.

Main results

Thirty-eight percent of institutionalized seniors experienced pain on a regular basis, compared with 27% of seniors living in households. In both populations, rates were higher for women than men. An increase in pain over a two-year period was associated with higher odds of being unhappy or having negative self-perceived health at the end of the period.

Conclusions

Chronic pain is a major health issue for seniors, particularly those in health care institutions. The reduction of pain symptoms, independent of the presence of chronic conditions, would have a positive impact on the well-being of seniors.

Keywords

Aging, cross-sectional studies, epidemiology, health surveys, logistic models, longitudinal studies, pain, prevalence, self-perceived health, unhappiness

Author

Pamela L. Ramage-Morin (1-613-951-1760; Pamela.Ramage-Morin@statcan.ca) is with the Health Information and Research Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

Throughout our lives we experience pain. It could be a temporary discomfort such as infant colic or a more chronic level of pain resulting from injury or disease. Although not pleasant, pain may be protective,[1] helping us survive.[2] As a symptom of injury, illness or disease, pain motivates us to seek treatment and teaches us to change our behaviour—the child who touches a hot surface, for example, learns to avoid further injury and heed parents' warnings. However, pain may be chronic and destructive, serving no useful purpose for survival.[2] Pain is usually considered chronic if it lasts anywhere from 3 to 6 months or more[3] or, alternatively, if it persists after an injury has healed.[2]

The importance of pain as a public health issue lies in the high prevalence and impact of this problem.[4-6] Professor Harald Breivik stated:

> "Chronic pain is one of the most underestimated health care problems in the world today, causing major consequences for the quality of life of the sufferer and a major burden on the health care system in the Western world. We believe chronic pain is a disease in its own right."[7]

Studies consistently show that the likelihood of experiencing pain increases with age.[6,8-10] Chronic pain threatens the quality of life for many seniors who are often

coping with other physical conditions, activity limitations, and cognitive changes.[8,11-14] Studies have shown that chronic pain is related to fatigue, malnutrition, addiction, loneliness, and loss of independence.[1,11,14-15] Pain control is identified by seniors as an important health care priority;[16,17] some fear a life in pain more than death.[2]

Anywhere from a quarter to as many as three-quarters of older adults suffer from chronic pain and are consequently limited in their mobility and dexterity.[11,14,18,19] For those residing in health care institutions, the range of chronic pain prevalence is estimated to be even higher.[4,5,20-22]

This is a concern in Canada where the number and proportion of seniors (aged 65 or older) are projected to grow. In 2005, seniors comprised 13% of the population.[23] By 2031, when the last of the baby boom generation has reached age 65, it is estimated that there will be between 8.9 and 9.4 million seniors in Canada, representing almost a quarter of the population.[24]

With an aging population, there is a need for chronic pain studies that focus specifically on seniors, including those residing in private households as well as in long-term health care institutions. Many studies have been based on samples from specific nursing homes or community groups,[3,10,12,13,25,26] but larger, population-based studies are required. Such needs are addressed in this study, which is based on cross-sectional and longitudinal data from the National Population Health Survey and the Canadian Community Health Survey. National estimates of the prevalence of pain are provided for seniors in private households and in long-term health care institutions. A unique feature of this study is the use of longitudinal data to assess how the onset of chronic pain is associated with the happiness and self-perceived health of senior Canadians.

Methods

Data sources

This article is based on data from the National Population Health Survey (NPHS) and the Canadian Community Health Survey (CCHS). Detailed documentation on both surveys can be found at Statistics Canada's Web site (http://www.statcan.ca). Descriptions of the NPHS design, sample, and interview procedures are available in published reports.[27,28] Sample sizes and response rates for the NPHS and CCHS are presented in Table 1.

National Population Health Survey

The NPHS, which began in 1994/1995, collects information about the health of the Canadian population every two years. It includes cross-sectional samples and longitudinal panels. The NPHS has three components: health care institutions, private households, and the North. This study is based on the first two components.

The NPHS *Health Institutions component* collected data from people living in hospitals, nursing homes, and facilities for people with disabilities. The institutions were sampled from a list of residential

Table 1
Response rates, National Population Health Survey and Canadian Community Health Survey

				Institutions			Households	
Survey	Cycle	Year	Panel	Sample	Institution response rate (%)	Individual response rate (%)	Sample	Cycle response rate (%)
National Population Health Survey	1	1994/1995	Longitudinal	2,287	95.5	93.6	20,095	83.6
	2	1996/1997	Longitudinal	2,287	100.0	95.9	17,276	92.8
	2	1996/1997	Cross-sectional	2,118	100.0	89.9	...	...
	3	1998/1999	Longitudinal	2,287	100.0	98.4	17,276	88.2
	4	2000/2001	Longitudinal	2,287	99.3	96.9	17,276	84.8
	5	2002/2003	Longitudinal	...	...	...	17,276	80.6
Canadian Community Health Survey	3.1	2005	Cross-sectional	...	...	...	132,947	78.9

... not applicable

care facilities collected by the Canadian Institute for Health Information and a list of hospitals maintained by the Health Statistics Division of Statistics Canada. The sample was restricted to facilities with at least four beds. In-scope institutions were stratified in three stages: first by geography (five regions excluding the territories); then by type of institution (institutions for the elderly, institutions for those who are cognitively impaired, and other rehabilitative institutions); and finally, by size (number of beds). The first two cycles (1994/1995 and 1996/1997) were both cross-sectional and longitudinal (collecting health information from the same individuals each cycle). Beginning in cycle 3 (1998/1997), the institutional component became strictly longitudinal.

Interviewers initially met with institution administrators to establish which residents would require proxy interviews because of illness or incapacity. Next-of-kin were contacted and given the option of completing the interview on their relative's behalf or having a knowledgeable staff member or volunteer respond for their relative. Most interviews were done in person, although telephone interviews were accepted for proxy respondents who could not be met in person.

The *household component* of the NPHS covers household residents in all provinces, except persons living on Indian reserves, on Canadian forces bases, and in some remote areas. The first three cycles (1994/1995, 1996/1997, and 1998/1999) were both cross-sectional and longitudinal. Beginning in cycle 4 (2000/2001), the household component became strictly longitudinal. People in the longitudinal sample are interviewed every two years. This analysis uses the cycle 5 (2002/03) longitudinal "square" file, which contains records for all responding members of the original panel whether or not information about them was obtained in all subsequent cycles.

Canadian Community Health Survey

The CCHS targets persons aged 12 or older who are living in private dwellings in the ten provinces and the three territories. People living on Indian Reserves or Crown lands, residents of institutions, full-time members of the Canadian Forces, civilian and military residents of Canadian Forces bases, and residents of certain remote regions are excluded. The CCHS covers approximately 98% of the Canadian population aged 12 or older. Cycle 3.1 began in January 2005 and was conducted over the following 12 months.

The CCHS is a sample survey with a cross-sectional design. Cycle 3.1 used three sampling frames to select the sample of households: 49% of the sample of households came from an area frame, 50% from a list frame of telephone numbers, and the remaining 1%, from a Random Digit Dialing sampling frame. The area frame designed for the Canadian Labour Force Survey was used to select sample for the CCHS. A multi-stage stratified cluster design was used to sample dwellings within this area frame. One person aged 12 or older was randomly selected from the sampled households.

The CCHS is composed of modules categorized as common, subsample and optional content. Common content comprises the major part of the questionnaire and is asked of all respondents. The subsample content is designed to reduce respondent burden by including only enough respondents to yield reliable estimates at the national and provincial levels. The optional content allows health regions to focus on issues of local importance.

This research is based on 25,672 respondents who were selected as part of the subsample that included the Health Utility Index module, which has questions about chronic pain. There are an additional 14,020 respondents from British Columbia, the only province that selected this module as optional content.

Definitions

Unless otherwise stated, definitions apply to both the CCHS and NPHS variables.

Chronic pain, the primary independent variable, is based on a response of "no" to the question: "Are you usually free of pain or discomfort?" People who experience chronic pain were asked about the severity: "How would you describe the usual intensity of your pain or discomfort?" They categorized their pain as mild, moderate or severe.

Activity interference was derived from the question: "How many activities does your pain or discomfort prevent?" A dichotomous variable was created

whereby responses of "none," "a few," or "some" were coded "0" (minor interference). Responses of "most," coded as "1," indicated a more major perception of interference.

Self-perceived health is one of two outcome variables. It is based on the question: "In general, would you say your health is: ..." The five response categories were combined into two: good/very good/excellent health comprises "positive" self-perceived health, while fair/poor health constitutes "negative" self-perceived health.

The second outcome variable, *self-perceived happiness*, is derived from the question: "How would you describe yourself as being usually?" People were considered "happy" if they indicated either of two categories: happy and interested in life/somewhat happy. The other three response categories were combined to indicate "unhappiness": somewhat unhappy/unhappy with little interest in life/so unhappy that life is not worthwhile.

An *increase in pain* is the primary independent variable in the longitudinal analysis. The analysis was limited to those with either no pain or mild pain at the start of each two-year period; those who reported "moderate" or "severe" pain at the end of the period were classified as having an increase in pain. The sample size for the household population was sufficient to further compare those who had experienced increases to moderate pain with those whose pain had increased to severe levels.

The presence of *chronic conditions* was established by asking respondents if they had been diagnosed by a health professional with a long-term chronic condition, one that had lasted, or was expected to last, at least six months. Respondents were read a list of conditions that included arthritis or rheumatism, high blood pressure, asthma, chronic bronchitis or emphysema, diabetes, epilepsy, heart disease, cancer, effects of a stroke, partial or complete paralysis, incontinence, Alzheimer's disease or other dementia, osteoporosis, cataracts, glaucoma, kidney disease, and other chronic condition. Only conditions that were listed at every cycle were included in the analyses. The list of conditions differs slightly between the household and institutional files. Conditions in the institutional file were used as a starting point and, where possible, matched to conditions from the household file. For institutions in 1994/1995, respondents were asked if they had difficulty controlling their bladder or bowels. In subsequent years, they were asked separate questions about urinary incontinence and bowel control. To be consistent with 1994/1995, these were combined into one chronic condition for all years. For household respondents, the incontinence question refers only to urinary incontinence. Appendix Table A contains a list of the chronic condition variables used in the longitudinal analysis.

The number of chronic conditions at baseline was included in the longitudinal analysis, categorized as none, one, or two or more conditions. New *chronic conditions* were those reported at follow-up that were not reported at baseline. They were counted and categorized in the same manner as the baseline chronic conditions.

All respondents were asked how many different medications they had taken in the past two days. People who had taken one or more were asked the names of their medications. These were subsequently coded using the Canadian edition of the *Anatomical Therapeutic Chemical (ATC) Classification System for Human Medications*. Pain medications were those that commenced with codes: M01 (anti-inflammatory and anti-rheumatic agents), M02 (topical products for joint and muscular pain), or N02 (analgesics). Medication use over the past two days was categorized as "no medication use," "medication use, but not pain medication," or "pain medication."

In addition to *sex*, a number of socio-demographic and administrative variables were used in this study. *Age* is included as a continuous variable in the multivariate models. The *working-age* population covers people aged 18 to 64. *Seniors* are aged 65 or older.

Education, a dichotomous variable, distinguishes those who had graduated from secondary school from those who had not.

Income was used for the cross-sectional analysis only. Total *personal income* over the past 12 months was used for the institutional population. This

includes income from all sources, before taxes and deductions. Based on the distribution, people were categorized into the following income groups:

Lower	No income to less than $10,000
Middle	$10,000 to less than $15,000
Higher	$15,000 or more

For the household population, total *household income* from all sources in the previous 12 months was adjusted for the 2004 low-income cutoff (LICO) specific to the household and community size. (The low-income cutoff is the threshold at which a family would typically spend a larger portion of its income than the average family on the necessities of food, clothing and shelter.) Adjusted household incomes were then grouped into deciles (10 groups each containing approximately equal numbers of respondents). Deciles were generated using weighted data. These deciles were grouped into three income categories: lower (deciles 1 to 3), middle (deciles 4 to 6), and higher (deciles 7 to 10) income.

Interviewers recorded whether the questionnaire was completed by the respondent or by *proxy*. This is a dichotomous variable where "1" indicates a questionnaire completed by proxy and "0" refers to interviews completed by respondents.

Statistical analyses

Cross-sectional analyses

Cycle 2 (1996/1997) of the NPHS institutional component and Cycle 3.1 (2005) of the CCHS were used for these analyses. Weighted frequencies and cross-tabulations were used to estimate the proportion of people with chronic pain by selected characteristics. In addition, cross-sectional data were used to calculate the excess number of cases of chronic pain in order to demonstrate how the burden of this condition is unequally distributed among Canadians.

Longitudinal analyses

Associations between an increase in pain over a two-year period and unhappiness and negative self-perceived health were based on data from the NPHS. Data were used from four cycles of the health institutions component (1994/1995 through 2000/2001) and five cycles of the private households component (1994/1995 through 2002/2003). Pooling of repeated observations was combined with logistic regression analysis. Three cohorts of observations were pooled for the institutional population with baseline years of 1994/1995, 1996/1997 and 1998/1999. Four cohorts of observations were used for the household population with baseline years of 1994/1995, 1996/1997, 1998/1999 and 2000/2001.

The study sample was limited to those who, at each baseline year:

- reported no pain or mild pain;
- were 65 or older; and
- provided a full response at baseline and follow-up (two years later).

Respondents were excluded if they moved between a health care institution and private household over the study period.

Text table A
Sample sizes for longitudinal analysis

Cohort	Baseline (Time 1)	Follow-up (Time 2)	Institutions	Households
1	1994/1995	1996/1997	798	1,826
2	1996/1997	1998/1999	414	1,863
3	1998/1999	2000/2001	253	1,747
4	2000/2001	2002/2003	..	1,694
Total			1,465	7,130

.. not available

It is possible that seniors contributed more than one record to the analysis. For example, a senior with no or mild pain in 1994/1995 is followed up two years later, contributing one record to the analysis. If that person reported no or mild pain in 1996/1997, or in any subsequent baseline year, they were followed up again two years later, contributing another record to the analysis. The bootstrap method accounts for the increase in variance that may result from having repeated observations, because the same individual is always in the same bootstrap sample.[29]

Logistic models were used on the pooled set of observations to estimate associations between an increase in pain over a two-year period and each quality of life outcome (unhappiness and negative self-perceived health). The restricted models contain

baseline characteristics (age, sex, education, existing chronic conditions, proxy status, and unhappiness or negative self-perceived health). A variable, "cycle," was included to control for differences between each two-year cohort. In addition, follow-up characteristics were entered into the restricted models (medication use, new chronic conditions, and proxy status). The full models contain the main exposure of interest (an increase in pain) in addition to the variables entered in the restricted models.

The longitudinal analyses were conducted on both sexes combined. Tests for interaction were carried out to establish whether the impact of an increase of pain on quality of life varied by sex. There were no significant interaction terms for either negative self-perceived health or unhappiness.

To account for survey design effects of the NPHS and CCHS, coefficients of variation and p-values were estimated, and significance tests were performed using the bootstrap technique.[30-32] The significance level was set at $p < 0.05$.

Results

The cross-sectional analysis for health care institutions is based on a sample of 1,711 seniors aged 65 or older, with a mean age of 84. Almost three-quarters (73%) of the sample were women. For the household population, the cross-sectional analysis includes 39,692 respondents, most of whom (30,713) were working age (18 to 64). Information from these respondents provides some context against which to compare seniors (8,979 respondents), the main focus of the study. The mean age of the senior sample was 75. Fifty-nine percent of the senior sample were women.

Prevalence and associated factors

Chronic pain is common among seniors, who are more likely to experience it than are younger, working-age people: 27% of seniors living in private households reported chronic pain, compared with 16% of people aged 18 to 64 (Table 2, Chart 1). Seniors living in long-term health care institutions were even more likely to experience chronic pain (38%).

Although seniors were more likely to report chronic pain than were working-age people, there was little difference between seniors of different ages. In institutions, those aged 85 or older were no more or less likely to report chronic pain than were younger residents. In the household population, there was no difference between the oldest and youngest seniors, although those aged 75 to 84 were more likely to report pain (30%) than were 65- to 74-year-olds (24%).

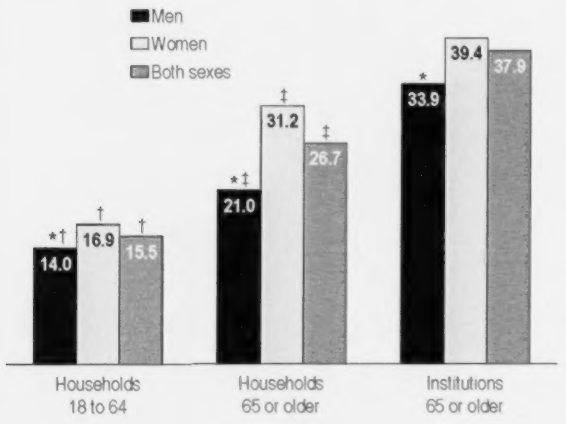
Among seniors, chronic pain was more common than a number of other major chronic conditions

Table 2
Prevalence of chronic pain, by selected characteristics, household and institutional populations aged 18 to 64 and 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)

	Households	Institutions
	%	%
18 to 64		
Total	15.5†	...
Sex		
Men	14.0†*	...
Women†	16.9†	...
65 or older		
Total	26.7§	37.9
Sex		
Men	21.0§*	33.9*
Women†	31.2§	39.4
Age group		
65 to 74†	24.4§	37.3
75 to 84	29.9§*	40.7
85 or older	29.5§	36.2
Education		
Less than secondary graduation	29.5§*	40.7*
Secondary graduation or more†	23.3§	32.6
Income		
Lower	28.1§*	40.2
Middle	25.4§	37.2
Higher†	22.8§	34.7
Proxy response		
Yes	39.7*	34.7*
No†	26.0§	42.4

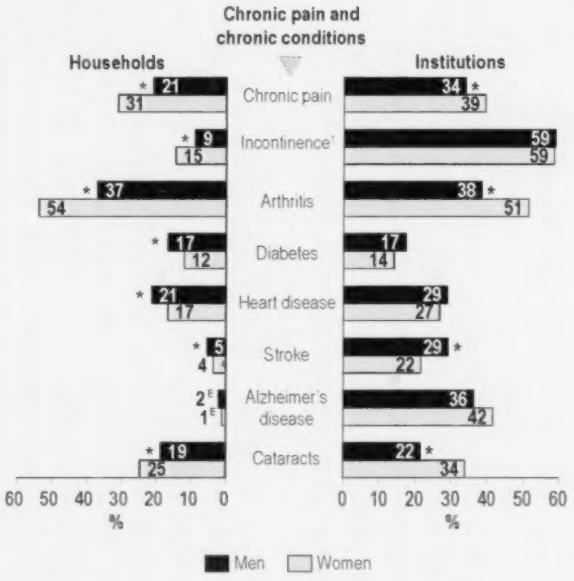
† reference category
‡ significantly different from estimate for household population aged 65 or older ($p < 0.05$)
§ significantly different from estimate for institutional population ($p < 0.05$)
* significantly different from estimate for reference category ($p < 0.05$)
... not applicable
Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

Chart 1
Prevalence of chronic pain, by sex, household and institutional populations aged 18 to 64 and 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)



* significantly different from estimate for women ($p < 0.05$)
† significantly different from estimate for household population aged 65 or older ($p < 0.05$)
‡ significantly different from estimate for institutional population ($p < 0.05$)
Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

Chart 2
Prevalence of chronic pain and selected chronic conditions, household and institutional populations aged 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)



* significantly different from estimate for women ($p < 0.05$)
† limited to urinary incontinence for the household population, but also includes bowel incontinence for the institutional population
E use with caution (coefficient of variation 16.6% to 33.3%)
Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

(Chart 2). For those residing in private households, it was more common than diabetes, heart disease, Alzheimer's disease, incontinence, cataracts or suffering from the effects of stroke. In institutions, only incontinence, arthritis and Alzheimer's disease were more common than chronic pain.

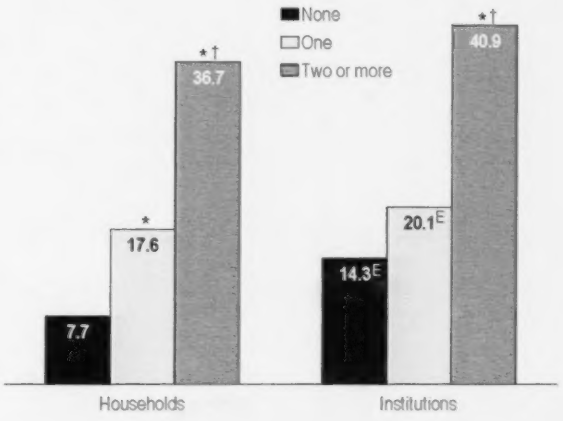
However, pain and chronic conditions were closely related. Over half of seniors living in households (56%) reported two or more chronic conditions, as did 83% of institutionalized seniors. And those with at least two chronic conditions were more likely to experience chronic pain than were those with fewer conditions (Chart 3).

Seniors with some common chronic conditions, such as arthritis, heart disease and diabetes, were generally more likely to report chronic pain than were those without the condition (Chart 4). A notable exception was institutionalized seniors with Alzheimer's disease, 28% of whom were reported to have chronic pain, compared with 43% of institutional residents who did not have Alzheimer's disease.

Women were consistently more likely than men to report chronic pain, regardless of whether they were working-age or older, living in an institution or not (Table 2). However, for the most part, among seniors with chronic pain, women were no more or less likely than men to report their pain as moderate or severe (Table 3). The exception was household residents: men reporting pain were more likely than women to rate their pain as mild.

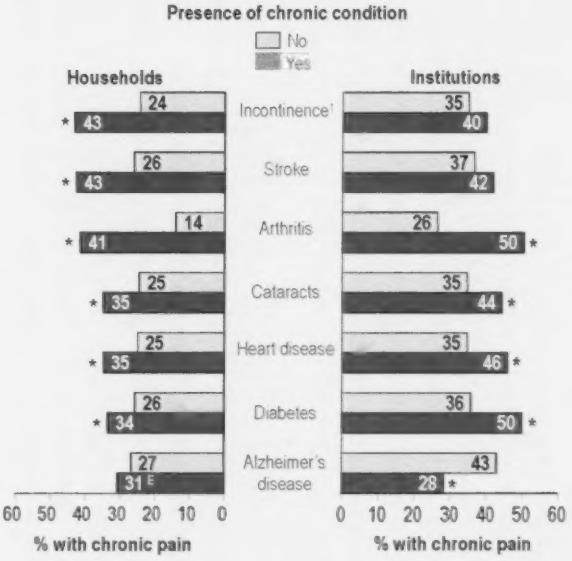
Education and income were used as markers of socio-economic status (Table 2). For education, 33% of institutional residents who had graduated from secondary school experienced chronic pain, compared with 41% of residents with less than secondary graduation. Prevalences were lower among the household population, but a similar pattern existed; 23% of secondary graduates had

Chart 3
Prevalence of chronic pain, by number of chronic conditions, household and institutional populations aged 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)



* significantly different from estimate for "None" ($p < 0.05$)
† significantly different from estimate for previous category ($p < 0.05$)
E use with caution (coefficient of variation between 16.6% and 33.3%)
Notes: The count of chronic conditions is based on arthritis, high blood pressure, asthma, bronchitis / emphysema, diabetes, epilepsy, heart disease, incontinence, cataracts, Alzheimer's disease, glaucoma, and the effects of stroke. Cancer is included for the household population; partial or complete paralysis, osteoporosis, kidney disease and other chronic conditions are included for the institutional population.
Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

Chart 4
Prevalence of chronic pain, by presence or absence of selected chronic conditions, household and institutional populations aged 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)



* significantly different from estimate for those without condition ($p < 0.05$)
† limited to urinary incontinence for the household population, but also includes bowel incontinence for the institutional population
E use with caution (coefficient of variation 16.6% to 33.3%)
Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

Table 3
Percentage distribution of people reporting chronic pain, by intensity of pain and sex, household and institutional populations aged 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)

Intensity of pain	Households	Institutions
	%	%
Mild	**27.4**	**22.4**
Men	34.1†*	18.7E
Women	23.7	23.6
Moderate	**54.7**	**50.0**
Men	50.5	57.0
Women	56.9†	47.8
Severe	**18.0†**	**27.6**
Men	15.4	24.4E
Women	19.4†	28.6

† significantly different from estimate for institutional population ($p < 0.05$)
* significantly different from estimate for women ($p < 0.05$)
E use with caution (coefficient of variation between 16.6% and 33.3%)
Note: Percentages based on people reporting chronic pain.
Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

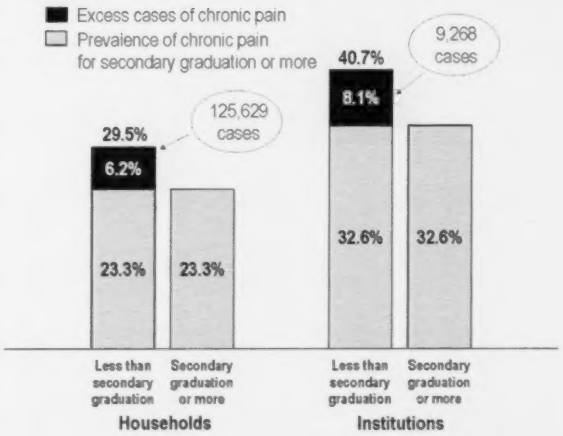
chronic pain, compared with 30% of those with less education.

Seniors whose household income was in the lower range were more likely to have chronic pain than were those with higher household incomes: 28% versus 23%. For institutional residents, despite a gradient in the prevalence of chronic pain, no significant differences existed between income groups.

The burden of chronic pain

The socio-economic gradient in chronic pain indicates a potential for improvement. Currently, the burden of this condition is not shared equally among Canadians. If seniors with less than secondary graduation experienced chronic pain to the same extent as those with more education, the prevalence of chronic pain in the former group

Chart 5
Prevalence of chronic pain, by educational attainment, household and institutional populations aged 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)



Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

would be 6.2 percentage points lower in the household population and 8.1 percentage points lower among those in institutions (Chart 5). These percentages represent around 125,600 residents of private households and almost 9,300 residents of institutions.

Table 4
Percentage whose pain interferes with most activities, by intensity of pain, household and institutional populations aged 65 or older, Canada excluding territories, 2005 (households) and 1996/1997 (institutions)

	Households	Institutions
	%	%
Total with pain	21.8†	42.3
Intensity of pain		
Mild	6.7†E	15.1E
Moderate	19.1†*	42.7*
Severe	52.7†*	63.8*

† significantly different from estimate for institutional population ($p < 0.05$)
* significantly different from estimate for "Mild" ($p < 0.05$)
E use with caution (coefficient of variation between 16.6% and 33.3%)
Note: Percentages based on people reporting chronic pain.
Sources: 2005 Canadian Community Health Survey; 1996/1997 National Population Health Survey, cross-sectional sample, Health Institutions component.

Many people reported that chronic pain interfered with their activities, and the more intense the pain, the more likely it was to interfere with most activities (Table 4). For the household population with severe pain, 53% stated that it interfered with most activities. Among institutional residents in severe pain, 64% reported major activity interference.

Pain and unhappiness

While the cross-sectional analysis provides a portrait of seniors who experienced pain, it is limited when discussing the temporal order between pain and quality of life. The following longitudinal analyses of NPHS data address this issue. The analyses are based on 1,465 responses for institutions and 7,130 responses for the household population (see Statistical analyses).

Apart from interfering with regular activities, it is evident from the NPHS that pain can contribute to feelings of unhappiness. The odds of being unhappy at the end of a two-year period were estimated, comparing seniors who had experienced an increase of pain over the two years with those who had not (Table 5). Having two or more chronic conditions to begin with, or two or more new chronic conditions diagnosed over the two-year period, contributed to people's unhappiness. However, even when these chronic conditions and other factors (socio-demographic factors and medication use) were taken into account, seniors who experienced an increase in pain had greater odds of being unhappy. In other words, it was not just illness that contributed to unhappiness; pain in and of itself had a profound impact. In institutions, after experiencing an increase in pain, seniors had over twice the odds (2.2) of being unhappy. Seniors living in private households had higher odds of being unhappy when they experienced an increase to moderate (2.0) or severe (6.4) pain, compared with those who did not report an increase in pain.

Pain and self-perceived health

As with unhappiness, many factors can account for negative self-perceived health, including existing and emerging chronic conditions, medication use, and socio-demographic factors (Table 6). However, it is clear from the NPHS that an increase in pain has

Table 5
Odds ratios relating unhappiness to selected characteristics with and without controlling for an increase in chronic pain, household and institutional populations aged 65 or older, Canada excluding territories, 1994/1995 to 2002/2003 (households) and 1994/1995 to 2000/2001 (institutions)

	Households				Institutions			
	Not controlling for pain		Controlling for pain		Not controlling for pain		Controlling for pain	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Two-year follow-up characteristics								
Increase in pain over 2 years								
No/Mild pain to moderate/severe pain	...	...	...	...	...	...	2.2*	1.5 to 3.3
No/Mild pain to moderate pain	...	...	2.0*	1.3 to 3.1	...	...	...	...
No/Mild pain to severe pain	...	...	6.4*	3.0 to 13.8	...	...	...	...
No change in pain†	...	...	1.0	...	...	...	1.0	...
Medication								
No medication†	1.0	...	1.0	...	1.0	...	1.0	...
Medication, but not pain medication	0.6*	0.4 to 1.0	0.6*	0.4 to 0.9	1.2	0.5 to 3.0	1.2	0.5 to 3.1
Pain medication	0.9	0.6 to 1.4	0.8	0.5 to 1.3	1.4	0.6 to 3.3	1.3	0.6 to 3.1
Chronic conditions								
No new chronic conditions†	1.0	...	1.0	...	1.0	...	1.0	...
1 new chronic condition	1.4	0.9 to 2.2	1.4	0.9 to 2.2	2.0*	1.2 to 3.3	2.0*	1.2 to 3.4
2 or more new chronic conditions	2.0*	1.2 to 3.4	1.8*	1.0 to 3.1	2.4*	1.6 to 3.5	2.3*	1.6 to 3.5
Proxy status								
No†	1.0	...	1.0	...	1.0	...	1.0	...
Yes	2.6*	1.3 to 5.5	2.6*	1.2 to 5.7	3.0*	2.0 to 4.5	3.0*	2.0 to 4.6
Baseline characteristics								
Unhappiness								
No†	1.0	...	1.0	...	1.0	...	1.0	...
Yes	11.6*	6.3 to 21.3	10.3*	5.3 to 19.8	2.7*	1.9 to 3.8	2.7*	1.9 to 3.8
Sex								
Men	1.1	0.8 to 1.6	1.1	0.7 to 1.6	0.9	0.6 to 1.2	0.9	0.6 to 1.3
Women†	1.0	...	1.0	...	1.0	...	1.0	...
Age (continuous)	1.02	0.99 to 1.05	1.01	0.99 to 1.05	1.00	0.98 to 1.02	1.00	0.98 to 1.02
Education								
Less than secondary graduation	1.0	0.7 to 1.5	1.0	0.7 to 1.4	0.9	0.6 to 1.1	0.8	0.6 to 1.1
Secondary graduation or more†	1.0	...	1.0	...	1.0	...	1.0	...
Chronic conditions								
No chronic conditions†	1.0	...	1.0	...	1.0	...	1.0	...
1 chronic condition	1.1	0.6 to 2.0	0.9	0.5 to 1.7	1.7	0.9 to 3.3	1.6	0.8 to 3.1
2 or more chronic conditions	2.5*	1.5 to 4.1	2.1*	1.2 to 3.5	2.1*	1.1 to 3.9	1.9	1.0 to 3.5
Proxy status								
No†	1.0	...	1.0	...	1.0	...	1.0	...
Yes	1.5	0.6 to 3.6	1.4	0.5 to 3.6	1.0	0.7 to 1.5	1.1	0.7 to 1.6

	Not controlling for pain	Controlling for pain	Not controlling for pain	Controlling for pain
Model information				
Sample size	6,735	6,729	1,202	1,178
Sample with unhappiness (at follow-up)	218	216	357	344
Records dropped because of missing values	395	401	263	287

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
... not applicable

Notes: A variable, "cycle," was included to control for differences between each two-year cohort; the odds ratios are not shown. All models are based on weighted data. Missing values for chronic conditions at baseline and new chronic conditions at two-year follow-up were included in models to maximize sample size; the odds ratios are not shown. Because of rounding, some odds ratios with lower or upper confidence limits of 1.0 were statistically significant.

Sources: 1994/1995 through 2002/2003 National Population Health Survey, longitudinal file, Household component and 1994/1995 through 2000/2001 National Population Health Survey, longitudinal file, Health Institutions component.

Table 6
Odds ratios relating negative self-perceived health to selected characteristics with and without controlling for an increase in chronic pain, household and institutional populations aged 65 or older, Canada excluding territories, 1994/1995 to 2002/2003 (households) and 1994/1995 to 2000/2001 (institutions)

	Households				Institutions			
	Not controlling for pain		Controlling for pain		Not controlling for pain		Controlling for pain	
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval
Two-year follow-up characteristics								
Increase in pain over 2 years								
No/Mild pain to moderate/severe pain	...	...	...	...	...	...	2.3*	1.7 to 3.1
No/Mild pain to moderate pain	...	...	3.5*	2.7 to 4.7	...	...	...	...
No/Mild pain to severe pain	...	...	6.9*	4.2 to 11.3	...	...	...	...
No change in pain†	...	...	1.0	...	...	...	1.0	...
Medication								
No medication†	1.0	...	1.0	...	1.0	...	1.0	...
Medication, but not pain medication	1.5*	1.2 to 2.0	1.5*	1.2 to 2.0	1.3	0.7 to 2.5	1.3	0.7 to 2.6
Pain medication	1.5*	1.1 to 2.0	1.4*	1.0 to 1.8	1.2	0.7 to 2.2	1.2	0.7 to 2.1
Chronic conditions								
No new chronic conditions†	1.0	...	1.0	...	1.0	...	1.0	...
1 new chronic condition	1.7*	1.4 to 2.1	1.6*	1.3 to 1.9	1.1	0.7 to 1.6	1.1	0.7 to 1.6
2 or more new chronic conditions	2.6*	2.0 to 3.4	2.4*	1.8 to 3.1	1.9*	1.3 to 2.8	1.8*	1.2 to 2.6
Proxy status								
No†	1.0	...	1.0	...	1.0	...	1.0	...
Yes	2.1*	1.3 to 3.3	2.0*	1.3 to 3.3	2.8*	2.0 to 3.9	2.6*	1.8 to 3.7
Baseline characteristics								
Negative self-perceived health								
No†	1.0	...	1.0	...	1.0	...	1.0	...
Yes	5.6*	4.5 to 7.1	5.4*	4.3 to 6.8	2.4*	1.8 to 3.0	2.3*	1.8 to 2.9
Sex								
Men	1.4*	1.2 to 1.7	1.4*	1.2 to 1.8	0.9	0.7 to 1.2	0.9	0.7 to 1.2
Women†	1.0	...	1.0	...	1.0	...	1.0	...
Age (continuous)	1.02*	1.00 to 1.03	1.01	1.00 to 1.03	0.99	0.97 to 1.00	0.99*	0.97 to 1.00
Education								
Less than secondary graduation	1.5*	1.3 to 1.9	1.5*	1.3 to 1.8	0.8	0.6 to 1.0	0.7	0.5 to 1.0
Secondary graduation or more†	1.0	...	1.0	...	1.0	...	1.0	...
Chronic conditions								
No chronic conditions†	1.0	...	1.0	...	1.0	...	1.0	...
1 chronic condition	1.4*	1.1 to 1.9	1.3*	1.0 to 1.8	1.3	0.7 to 2.3	1.2	0.7 to 2.2
2 or more chronic conditions	2.4*	1.9 to 3.2	2.1*	1.6 to 2.8	2.5*	1.5 to 4.1	2.2*	1.3 to 3.7
Proxy status								
No†	1.0	...	1.0	...	1.0	...	1.0	...
Yes	1.1	0.7 to 1.8	1.0	0.6 to 1.7	0.7*	0.6 to 1.0	0.8	0.6 to 1.0
	Not controlling for pain		Controlling for pain		Not controlling for pain		Controlling for pain	
Model information								
Sample size	6,760		6,748		1,311		1,267	
Sample with unhappiness (at follow-up)	1,295		1,288		716		678	
Records dropped because of missing values	370		382		154		198	

† reference category
* significantly different from estimate for reference category ($p < 0.05$)
... not applicable

Notes: A variable, "cycle," was included to control for differences between each two-year cohort; the odds ratios are not shown. All models are based on weighted data. Missing values for chronic conditions at baseline and new chronic conditions at two-year follow-up were included in models to maximize sample size; the odds ratios are not shown. Because of rounding, some odds ratios with lower or upper confidence limits of 1.0 were statistically significant.

Sources: 1994/1995 through 2002/2003 National Population Health Survey, longitudinal file, Household component and 1994/1995 through 2000/2001 National Population Health Survey, longitudinal file, Health Institutions component.

an independent effect on self-perceived health. Seniors living in private households had higher odds (3.5) of reporting negatively on their general health after their pain increased to moderate levels, compared with those who remained pain-free or with low levels of pain. The odds were even higher (6.9) for those who suffered an increase to severe levels of pain. A similar relationship between an increase in pain and negative self-perceived health existed among institutionalized seniors, with an odds ratio of 2.3 for any increase in pain to moderate or severe levels.

Discussion

The present study provides benchmarks for the prevalence of chronic pain in Canada. In the household population, seniors were more likely to report chronic pain (27%) than were people of working age (16%). The prevalence of chronic pain, however, was highest among seniors in long-term care institutions (38%). It is possible that these prevalences are underestimates, as seniors have been known to underreport their pain.[3] This may result from the belief that pain is a natural part of aging, which must be endured with the passage of time.[1,11,33] Alternatively, some seniors who fail to report their pain may do so because they fear that their complaints could negatively influence their care.[18]

A comparison with other population-based studies revealed a wide range in the reported prevalence of chronic pain. A third of of US seniors (70 or older) living in private households had pain often.[19] A Finnish study revealed that 35% of the general population aged 15 to 74 reported chronic pain.[10] An earlier Canadian study found that 29% of adults reported chronic, non-cancer pain,[34] while an Australian study reported chronic pain among 17% of men and 20% of women.[6] Finally, a UK study[8,9] estimated that almost half (47%) the general population aged 25 or older had "any chronic pain," while estimates for "significant" and "severe" chronic pain were 12% and 6%, respectively.

Studies based on specific communities and nursing homes report sample prevalences that are generally higher than the population-based studies. From a community sample of seniors admitted to home care programs in Italy, Landi et al.[35] reported that 40% experienced pain daily. Three-quarters of subjects studied by Ross et al.[11] were frequently troubled with pain or experienced pain of a noteworthy nature within the two-week period before their interview. This was based on a small sample (66) of seniors aged 64 to 99 years who received care from the Ottawa-Carleton branch of the Victorian Order of Nurses. From non-representative samples of studies of nursing home residents, the prevalences of pain ranged between 50% and 83%,[5,20-22,36] far higher than the prevalence from the NPHS (38%) for health care institutions.

The variety of prevalences may reflect real geographic and cultural differences in chronic pain or differences in research methods. With regard to research methods, the nature of the different samples is a factor, as well as different survey questions and time-frames. NPHS and CCHS respondents were asked about the absence of pain ("Are you usually free of pain or discomfort?"). In contrast, other studies ask directly about pain. For example "How much bodily pain have you had during the past four weeks?"[37] and "Have you been troubled by pain for the last three months?"[38] In addition, it is clear that many different time-frames are used, such as the experience of pain in the past four weeks,[37] two weeks,[11] preceding week,[10,35] and current pain.[20] Alternatively, the time-frame may not be specified, asking respondents if they are *usually* free of pain (present study) or *often* bothered by pain.[19] The different time-frames, or absence of a specific time-frame, likely contribute to different prevalences.

Other differences between studies include definitions of pain, the use of direct (self-reported or chart review) or indirect (analgesic use) measures of pain, the type of pain being assessed (chronic or acute), and whether non-communicative respondents were included.[5] Ross et al.[11] recognize these issues when they recommend that researchers adopt standard ways of defining pain sufferers and measuring pain.

The inclusion or exclusion of seniors with cognitive or communication impairments is an

important consideration that likely has an impact on the reported prevalence of pain.[13] Pain, by definition, is subjective;[3] in Levy's words: "Pain is what the patient says it is and occurs when he or she says it does."[39] How then to work with seniors who are unable to communicate the presence or extent of their pain because of cognitive problems, speech, hearing, or other difficulties? Studies consistently show that the prevalence of pain is lower among seniors with higher levels of cognitive impairment.[13,36] These studies highlight the need for better assessment and management of pain for those who cannot advocate on their own behalf.[20] Seniors with cognitive or communication impairments rely on a family member, staff person or friend to speak on their behalf.[26] People regularly make objective assessments about the pain of others through signs such as limping, flinching from physical contact, groaning, facial expressions, guarding parts of the body, and so on. Although these objective assessments are useful, they are subject to interpretation (or misinterpretation).[13] People may also gauge pain by the amount of damage that has been done to a person's body—certain conditions look very painful. However, while chronic pain may be related to a particular disease or injury, for many, the cause remains unexplained, persisting in the absence of injury or after the healing process appears complete.[2,20,40]

It is evident from this study that in institutions there is a lower prevalence of pain among those with Alzheimer's disease, compared with those without this condition. Most people (93%) in the institutional sample with Alzheimer's disease relied on a family member, friend or staff member to respond on their behalf. This suggests that proxy respondents are less likely to report the presence of pain, at least in institutions. In fact, the estimate of chronic pain among institutional residents was significantly lower for proxy reports (35%), compared with self-reports (42%). Consequently, the overall estimate for chronic pain within institutions (38%) is more conservative than it would be if the proxy respondents (and therefore, most people suffering from Alzheimer's disease) had been excluded. In contrast, proxy respondents for the household population were more likely to report chronic pain (40%) than those with self-reports (26%). However, because only 4% of sampled seniors in private households relied on proxy respondents (compared with 59% of seniors in institutions), this "overestimation" of chronic pain in households did not have a great impact on the overall prevalence of pain (27%). These results emphasize the need to control for proxy respondents in the multivariate analyses.

As with many conditions, chronic pain is not evenly distributed among the population. Women are more likely to report chronic pain,[8,9,13,19] as are people with lower socio-economic status.[8,9,19] The present study supports these findings. When measuring socio-economic status for people residing in institutions, only education was significant. It is possible that for seniors, level of education is more sensitive than current income as a measure of socio-economic status, reflecting past lifestyle and environmental factors that may affect health.

Pain has been implicated as interfering with physical activity, recreation, family responsibilities and self-care.[4,11,14,37] Findings from the CCHS and NPHS support the association between pain and activity interference. The survey question does not specify the type or number of activities and so leaves respondents free to rate the interference of pain relative to normal activities and expectations. What is interesting is that although seniors living in health care institutions may be perceived as having fewer activities in their daily lives (with the institutions being responsible for grocery shopping, laundry, cooking, and other daily activities), their reported interference was greater regardless of the level of pain they experienced.

In addition to interfering with activities and responsibilities, chronic pain has been shown to have an impact on happiness and self-perceived health. Institutionalized seniors who were usually pain-free had higher odds of reporting positive self-perceived health than did those with chronic pain.[41] Among non-institutionalized adults, those who suffered chronic pain had higher odds of reporting poor self-rated health.[10,19] The longitudinal nature of the present study provides even stronger evidence for

the relationship between pain and self-perceived health or unhappiness. When people who were initially free of pain or reported only mild pain experienced an increase in pain to moderate or severe levels over a two-year period, they had higher odds of being unhappy or reporting negatively about their health.

Limitations

The current study has a number of limitations. Chronic conditions are self-reported. Respondents were asked if they had chronic conditions diagnosed by a health professional, but their responses were not verified by any other source. The list of chronic conditions in the institutional questionnaire differed from those presented to the household population. Consequently, the count of chronic conditions may vary between household and institutional residents, in part because the lists of conditions were not identical. In addition, some chronic conditions were omitted because they were not included in every cycle of the longitudinal file.

While recent data (2005) are available for the cross-sectional analysis of the household population, the latest cross-sectional data for people living in institutions are for 1996/1997. Thus, the prevalence of pain reported for residents of health care institutions is at least 10 years old. The absence of current data from representative samples of institutionalized seniors limits the ability to conduct relevant analysis on this sector of the population.

Finally, as already discussed, 59% of the seniors' interviews were completed by proxy respondents in the 1996/1997 NPHS Health Institutions component, compared with 4% of interviews for seniors residing in households in the 2005 CCHS. As demonstrated, this appears to introduce a bias into the prevalences.

Conclusion

Chronic pain is a debilitating condition that affects many aspects of people's lives.

It is a major health concern for seniors, many of whom are already coping with the changes wrought by aging—chronic diseases, cognitive problems, and the need for medications, for example. Chronic pain is common, affecting 27% of seniors living in households and 38% of those in health care institutions. The impact of this public health problem will likely grow as Canada's population ages. What is evident from this analysis is that efforts focused on reducing pain would have a positive impact on the happiness and self-perceived health of seniors. Seniors likely accept that many diseases cannot be cured, but would experience a better quality of life if their pain could be adequately assessed and controlled. ●

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Appendix

Table A
Chronic diseases included in Health Institutions and Household components of National Population Health Survey, by cycle, 1994/1995 to 2002/2003

	Health institutions component				Household component				
	1994/1995	1996/1997	1998/1998	2000/2001	1994/1995	1996/1997	1998/1998	2000/2001	2002/2003
Arthritis or rheumatism	1	1	1	1	1	1	1	3	3
Arthritis or rheumatism excluding fibromyalgia	3	3	3	3	3	3	3	1	1
Fibromyalgia	3	3	3	3	3	3	3	2	2
High blood pressure	1	1	1	1	1	1	1	1	1
Asthma	1	1	1	1	1	1	1	1	1
Chronic bronchitis/emphysema	1	1	1	1	1	1	1	1	1
Diabetes	1	1	1	1	1	1	1	1	1
Epilepsy	1	1	1	1	1	1	1	1	1
Heart disease	1	1	1	1	1	1	1	1	1
Cancer	2	3	2	2	1	1	1	1	1
Effects of stroke	1	1	1	1	1	1	1	1	1
Partial or complete paralysis	1	1	1	1	3	3	3	3	3
Urinary incontinence	1	1	1	1	1	1	1	1	1
Bowel incontinence		1	1	1	3	3	3	3	3
Bowel disorder (Crohn's Disease or colitis)	3	2	2	2	3	2	2	2	2
Alzheimers or other dementia	1	1	1	1	1	1	1	1	1
Osteoporosis or brittle bones	1	1	1	1	3	3	3	3	3
Cataracts	1	1	1	1	1	1	1	1	1
Glaucoma	1	1	1	1	1	1	1	1	1
Stomach or intestinal ulcers	3	2	2	2	2	2	2	2	2
Kidney failure or disease	1	1	1	1	3	3	3	3	3
Thyroid conditions	3	2	2	2	3	2	2	2	2
Other chronic condition	1	1	1	1	1	1	1	1	1

Notes:
1 = included in survey cycle, used in analysis
2 = included in survey cycle, not used in analysis
3 = not included in survey cycle
For health institutions, incontinence refers to urinary or bowel incontinence; for households, incontinence refers to urinary incontinence only.
Sources: 1994/1995 to 2002/2003 National Population Health Survey, Health Institutions and Household components.

Health care use among gay, lesbian and bisexual Canadians

Michael Tjepkema

Abstract

Objective

This article examines whether consultations with health care providers, not having a regular doctor, unmet health care needs, and receipt of preventive screening tests vary by sexual identity for Canadians aged 18 to 59.

Data source

Results are based on the Canadian Community Health Survey, combined 2003 and 2005 data.

Analytical techniques

Cross-tabulations were used to compare utilization rates of selected health care providers by sexual identity. Multiple logistic regression models that controlled for predisposing, enabling and health need variables were employed to ascertain if sexual identity was independently associated with health care use, not having a regular doctor, unmet health care needs, and receipt of preventive screening tests.

Main results

Gay men, lesbians and bisexual people were more likely than heterosexuals to consult mental health service providers. Lesbians had lower rates of consulting family doctors and were less likely to have had a Pap test, compared with heterosexual women. Bisexuals reported more unmet health care needs than did their heterosexual counterparts.

Keywords

Homosexuality, family physicians, health care services accessibility, health status, mammography, Pap smear test

Author

Michael Tjepkema (416-952-4620; Michael.Tjepkema@statcan.ca) is with the Health Information and Research Division at Statistics Canada in the Toronto Regional Office, 25 St. Clair Avenue E., Toronto, Ontario, M4T 1M4.

While a variety of factors have been studied in relation to the decision to seek health care,[1] relatively little research has examined health care use and access by sexual orientation.[2-4] Much of the information about the role of sexual orientation in access to care comes from American studies, the balance of which suggests that gay men, lesbians and bisexuals experience unique obstacles. This research shows that lesbians are less likely than heterosexual women to have a regular source of care such as a family doctor, and more likely to report difficulties in access due to cost.[2,5-8] Some gay men, lesbians and bisexuals have reported negative experiences with the health care system related to their sexuality,[8-10] and, as a result, avoid or delay seeking care.[11-13]

These findings, which are based primarily on data from the United States, may not reflect the situation in Canada, as the two countries have different health care systems. For instance, while many American studies have found an association between not having health insurance and lower rates of utilization, this should not be the case in the Canadian universal health insurance environment.[14]

As well, societal differences may limit the generalizability of American findings to a Canadian context.

The primary objective of this analysis is to determine if consultations with health care providers, not having a regular doctor, unmet needs, and receipt of preventive screening tests vary by sexual identity. The data come from Statistics Canada's Canadian Community Health Survey (CCHS), a large-scale national probability survey. The CCHS does not have the problems associated with non-probability surveys, such as volunteer bias, or with surveys based on small geographic areas whose results cannot necessarily be generalized. The CCHS collected information on a wide assortment of socio-demographic and health-related variables that can be used to control potential confounding when determining if health care use and access differ by sexual identity. The large sample size enables separate analyses for gay men, lesbians, and bisexuals, an important consideration, as some research has shown that bisexuals' health care utilization patterns differ from those of gay men, lesbians and heterosexuals.[3,5,15,16]

Methods

Data source

Estimates are based on combined data from the 2003 and 2005 CCHS, cycles 2.1 and 3.1. The CCHS covers the household population aged 12 or older in all provinces and territories, except members of the regular Forces and residents of institutions, Indian reserves, Canadian Forces bases and some remote areas.

Data for cycle 2.1 were collected from January through December 2003 from a sample of 135,573 people; the response rate was 81%. Data for cycle 3.1 were collected from January through December 2005 from a sample of 132,947 people; the response rate was 79%. In each cycle, about 25% of interviews were conducted in person, and 75%, by telephone. More information about the CCHS is available in a published report[17] and on Statistics Canada's Web site (www.statcan.ca).

Data for the population aged 18 to 59 who indicated their sexual identity were used in this analysis. Among men, 1,103 self-identified as gay, 498 as bisexual, and 72,972 as heterosexual. For women, 695 self-identified as lesbians, 833 as bisexual, and 83,723 as heterosexual. Respondents whose sexual identity was not known were excluded (3,662 men and 3,289); of these respondents, 767 men and 713 women refused to answer the question on sexual identity.

Analytical techniques

To compensate for the relatively small number of gay, lesbian and bisexual respondents, data from the 2003 and 2005 CCHS (cycles 2.1 and 3.1) were combined. This is feasible because the methodology is similar, and the wording of the questions used in this analysis is identical, except for how Aboriginal respondents were ascertained (see Definitions).[18]

For this analysis, the cycles were combined at the micro-data level, resulting in one dataset. Because sample weights were only available for each cycle separately, the total weighted population for the combined cycles would represent roughly twice the Canadian population. To obtain an estimate of the number of gay men, lesbians and bisexuals, the estimate was divided by two. Percentages and regression results did not have to be divided by two.

Between 2003 and 2005, the number of self-identified gay men, lesbians and bisexuals increased by 13% to 20% (depending on the group), which suggests that respondents might have been more likely to disclose a non-heterosexual identity in 2005 than in 2003. Results from the forthcoming 2007 CCHS (cycle 4.1) will confirm if this trend continues.

Andersen's health behaviour model[1] provided the framework for the selection of explanatory variables in the modelling of health care utilization. The Andersen model proposes that the decision to seek care is influenced by predisposing factors such as age, gender and health beliefs; enabling factors such as income education and service availablility; and need factors such as health status and chronic conditions.[1] For this analysis, the model provided guidance in variable selection, based on the information available in the CCHS.

Unadjusted logistic regression models were run by gender for each health care use variable: consultation in the past 12 months with: family doctor or general practitioner, medical specialist, nurse, social worker or counsellor, psychologist, alternative health care provider, self-help group; no regular doctor; unmet health care need; mammogram in past two years (women aged 50 to 59); and Pap test in past three years (all women). To improve comparability with adjusted logistic regression models, observations with missing data for independent variables used in the adjusted models (except income and education) were excluded from the unadjusted models. This ensured that the number of observations for each dependent variable was the same between the unadjusted and adjusted models. Regardless of statistical significance, the following variables were controlled in the adjusted logistic regression models: age (continuous), marital status, presence of child(ren) younger than 12 in household, education, household income quintile, place of residence, cultural or racial group, having a regular doctor (for all regression models except where it is the outcome), number of chronic conditions, self-perceived general health, two-week physical disability day, self-perceived mental health, diagnosed anxiety disorder, diagnosed mood disorder, two-week mental disability day, and survey cycle.

To account for survey design effects, standard errors and coefficients of variation were estimated with the bootstrap technique.[19,20] The significance level was preset at $p < 0.05$. Proportions were estimated using the CCHS sample weights.

Definitions

Epidemiological studies do not agree on a definition of sexual orientation—it depends on the research question and on data availability.[21] Sexual orientation consists of three distinct elements: 1) sexual attraction/fantasy; 2) sexual behaviour; and 3) self-identification.[21] Although the three overlap, each measures sexual orientation slightly differently, with sexual attraction/fantasy the most inclusive, yielding the highest prevalence, and self-identification the most restrictive, yielding the lowest prevalence.[22] The CCHS asked, "Do you consider yourself to be heterosexual (sexual relations with people of the opposite sex), homosexual, that is lesbian or gay (sexual relations with people of your own sex) or bisexual (sexual relations with people of both sexes)?" This question was read to all respondents aged 18 or older in 2003, and to respondents aged 18 to 59 in 2005.

Health care use was determined by asking: "Not counting when you were an overnight patient, in the past 12 months, how many times have you seen, or talked on the telephone, about your physical, emotional or mental health with: a family doctor or general practitioner (GP), any other medical doctor (such as a surgeon, allergist, orthopedist, gynecologist or psychiatrist), a nurse for care or advice, a social worker or counsellor, a psychologist?"

Alternative health care was ascertained by the question: "People may also use alternative or complementary medicine. In the past 12 months, have you seen or talked to an alternative health care provider such as an acupuncturist, homeopath or massage therapist about your physical, emotional or mental health?"

Respondents were asked if they had attended a meeting of a *self-help group* such as AA or a cancer support group in the past 12 months.

Respondents were asked if they had a regular medical doctor. If they answered "no," they were considered to have *no regular doctor*.

Respondents who answered "yes" to the following question were considered to have *unmet health care needs*: "During the past 12 months, was there ever a time when you felt that you needed health care but you didn't receive it?"

Female respondents aged 35 or older were asked about *mammography*: "Have you ever had a mammogram, that is, a breast x-ray?" Those who answered "yes" were asked, "When was the last time?", with the interviewer reading five categories: less than 6 months ago, 6 months to less than 1 year ago, 1 year to less than 2 years ago, 2 years to less than 5 years ago, and 5 or more years ago. For this analysis, mammogram use was determined for women aged 50 to 59, with these women dichotomized as either having had a mammogram in the past 2 years or more than 2 years ago/never.

Pap test was determined by asking female respondents, "Have you ever had a Pap smear test?" Those who answered "yes" were asked, "When was the last time?", with five categories read by the interviewer: less than 6 months, 6 months to less than 1 year ago, 1 year to less than 3 years ago, 3 years to less than 5 years ago, and 5 or more years ago. For this analysis, last Pap test was dichotomized as within 3 years or more than 3 years ago/never.

Four *age* groups were established: 18 to 24, 25 to 34, 35 to 44, and 45 to 59. In logistic regression analysis, age was entered as a continuous variable.

Marital status was categorized into three groups: married or common-law; previously married (divorced, separated or widowed); and single (never married).

Place of residence was determined by grouping Census Metropolitan Areas (CMAs) (http://www12.statcan.ca/english/census01/Products/Reference/dict/geo009.htm). A CMA consists of one or more adjacent municipalities situated around a major urban core with a population of at least 100,000.[23] Three groups were created: CMA with population greater than 2 million (Montreal, Toronto and Vancouver), CMA with population between 100,000 and 2 million, and area outside CMAs with population less than 100,000.

Based on their highest level of *education*, respondents were grouped into four categories: postsecondary graduation, some postsecondary, secondary graduation, and less than secondary graduation. Missing values were included in multiple logistic regression models.

Household income quintiles were determined with a method developed at Statistics Canada.[24] For each respondent, a household weight factor was calculated on household size. The first household member was assigned a weight of 1, the second, a weight of 0.4, and the third and subsequent members, a weight of 0.3. The household weight factor was then calculated as the sum of these weights. Household income was divided by this household weight factor to derive income adjusted for household size. In instances where household income range rather than exact household income was available, the mid-point of the reported range was used to calculate total household income. For this analysis, the weighted distribution of each CCHS cycle (2003 and 2005) for the population aged 18 to 59 was examined to establish cut-points for household income quintiles within each geographic classification (CMA population greater than 2 million, CMA population 100,000 to 2 million, and non-CMA with less than 100,000). Quintiles were calculated for each CCHS cycle and combined. In logistic regression analysis, records with missing income data (approximately 13% of the population) were included as a dummy variable.

To determine a respondent's *racial or cultural* group, the interviewer read the following statement: "People living in Canada come from many different cultural and racial backgrounds," and then asked if the respondent was: White, Black, South Asian, Southeast Asian, Filipino, Latin America, Arab, West Asian, Japanese, Korean, Aboriginal, or other. For this analysis, racial or cultural group was classified into two categories: White and non-white. In 2005 and part of 2003, a separate question was asked to determine Aboriginal identity. Respondents who self-identified as Aboriginal were not asked their racial or cultural group, but were included with other non-white respondents.

Self-perceived general health was assessed with the question, "In general, would you say your health is: excellent, very good, good, fair or poor?" Three categories were established: excellent or very good, good, and fair or poor.

Self-perceived mental health was assessed with the question, "In general, would you say your mental health is: excellent, very good, good, fair or poor?" Three categories were established: excellent or very good, good, and fair or poor.

Number of chronic conditions was determined by asking respondents if they had "long-term conditions that had lasted or were expected to last six months or more and that had been diagnosed by a health professional." The interviewer read a list of conditions; those included in this analysis (26) were: food allergies, other allergies, asthma, fibromyalgia, arthritis or rheumatism, back problems, high blood pressure, migraine, chronic bronchitis, diabetes, epilepsy, heart disease, cancer, stomach or intestinal ulcers, effects of stroke, urinary incontinence, bowel disorder, dementia, cataracts,

glaucoma, thyroid condition, chronic fatigue syndrome, multiple chemical sensitivity, emphysema or chronic obstructive pulmonary disease, or any other long-term physical or mental condition.

Mood disorder was determined by asking, "Do you have a mood disorder such as depression, bipolar disorder, mania or dysthymia?" that had been diagnosed by a health professional.

Anxiety disorder was determined by asking, "Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder?" that had been diagnosed by a health professional.

Two-week disability (physical and mental) was measured in terms of bed-days and "cut-down" days over the previous two weeks. Respondents were asked about days they stayed in bed (including nights in hospital) and about days they cut down normal activities because of illness or injury. Those who reported at least one disability day were asked if it was due to their emotional or mental health or use of alcohol or drugs. Responses were dichotomized as "yes" (at least one disability day) or "no."

Results

Population characteristics

An estimated 346,000 adults self-identified as gay, lesbian or bisexual, together representing 1.9% of Canadians aged 18 to 59 (2.1% of men and 1.7% of women). The breakdown was: 130,000 gay men (1.4% of men aged 18 to 59), 59,000 bisexual men (0.7%), 71,000 lesbians (0.8% of women aged 18 to 59), and 85,000 bisexual women (0.9%).

Compared with the heterosexual population, a larger proportion of gay men and lesbians were aged 35 to 44, whereas bisexuals, especially women, were considerably younger (Table 1).

Not surprisingly, marital status varied by sexual identity. Gay men, lesbians and bisexuals were more likely than heterosexuals to be single (never married), and less likely to be married or in a common-law relationship.

About three in ten heterosexuals had a child younger than 12 living in their household. The proportions were much lower for gay men (2.6%) and lesbians (8.4%). Proportions were also low for bisexuals (18.5% of men and 26.1% of women), although when never-married people were excluded, the difference between heterosexuals and bisexuals disappeared (data not shown).

Compared with heterosexuals, gay men and lesbians had high levels of education; the educational attainment of bisexual men was lower. Relatively large proportions of gay men and lesbians were in the highest household income quintile, compared with the heterosexual population; bisexual men and women were over-represented in the lowest quintile.

Cultural and racial background and place of residence also differed by sexual identity. Higher

Table 1
Distribution of household population aged 18 to 59, by gender, sexual identity, and selected socio-demographic and economic characteristics, Canada, 2003 and 2005 combined

	Men			Women		
	Hetero-sexual	Gay	Bi-sexual	Hetero-sexual	Lesbian	Bi-sexual
	%	%	%	%	%	%
Age group						
18 to 24	16.3	9.7*	23.9*	15.4	10.5*E	35.9*
25 to 34	21.8	22.5	18.1	22.3	22.1	26.8*
35 to 44	27.6	36.3*	22.2*	26.9	36.4*	21.2*
45 to 59	34.3	31.5	35.7	35.3	30.9	16.1*
Marital status						
Married or common-law	64.4	31.8*	39.9*	65.6	38.5*	40.9*
Previously married	6.0	4.0*	7.3E	10.1	9.3	10.5
Single (never married)	29.6	64.2*	52.9*	24.3	52.2*	48.6*
Children younger than 12 in household	29.5	2.6*E	18.5*E	31.1	8.4*	26.1*
Education (aged 25 to 59)						
Less than secondary	12.1	4.4*E	16.2	10.6	6.1*E	10.7
Secondary	16.7	10.2*	15.8E	18.1	13.4*	19.1
Some postsecondary	6.7	9.3	14.4E	6.8	6.1E	9.4E
Postsecondary	64.5	76.1*	53.6*	64.4	74.4*	60.7
Income quintiles						
Lowest	17.0	15.5	34.9*	22.0	19.0	42.7*
Second-lowest	19.5	14.6*	29.1*	21.2	15.3*	22.0
Middle	20.1	17.9	12.4*	20.3	22.1	14.5*
Second-highest	21.2	22.0	11.6*	19.2	20.0	12.0*
Highest	22.1	29.9*	12.0*E	17.3	23.4*	8.8*E
Racial or cultural group						
White	82.4	88.1*	76.0	82.7	89.1*	81.9
Non-white	17.6	11.9*	24.0	17.3	10.9*E	18.1
Place of residence						
Montreal, Toronto or Vancouver	34.9	55.9*	47.0*	35.1	41.0*	34.9
CMA 100,000 to 2 million	31.9	28.3*	24.9*	32.1	35.1	31.3
Non-CMA (less than 100,000)	33.1	15.8*	28.1	32.8	23.9*	33.8

* significantly different from estimate for heterosexual population of same gender ($p < 0.05$)
E use with caution (coefficient of variation 16.6% to 33.3%)
Note: Missing values are excluded.
Source: 2003 and 2005 Canadian Community Health Survey (combined data).

proportions of gay men and lesbians were White, compared with heterosexuals and bisexuals. As well, comparatively large percentages of gay men, lesbians and bisexual men lived in Montreal, Toronto or Vancouver.

Physical and mental health

The self-perceived general health of gay men and lesbians was similar to that of heterosexuals (Table 2). By contrast, bisexuals were more likely than heterosexuals to report fair or poor health.

Gay men and bisexual women tended to report more chronic conditions than did the heterosexual population. They were also more likely to have had at least one disability day due to physical illness in the previous two weeks.

Table 2
Health status indicators, by gender and sexual identity, household population aged 18 to 59, Canada, 2003 and 2005 combined

	Men			Women		
	Hetero-sexual	Gay	Bi-sexual	Hetero-sexual	Lesbian	Bi-sexual
	%	%	%	%	%	%
Physical health						
Self-perceived general health						
Excellent or very good	63.9	65.4	57.1	63.8	63.2	51.6*
Good	28.5	26.0	30.9	27.5	26.9	32.2
Fair or poor	7.7	8.5	12.0*	8.7	9.8	16.2*
Chronic conditions						
None	50.5	42.1*	49.6	39.9	35.9	31.3*
One	27.9	28.9	25.5	27.6	29.4	27.8
Two	12.6	17.5*	13.6	15.9	15.9	16.9
Three or more	9.0	11.5*	11.3	16.5	18.7	23.9*
Disability day in past two weeks (physical)	13.6	17.9*	11.7	19.2	22.6	27.0*
Mental health						
Self-perceived mental health						
Excellent or very good	75.4	73.8	66.7*	74.8	72.8	57.5*
Good	20.3	20.5	23.9	19.9	20.6	25.5*
Fair or poor	4.3	5.7	9.4*E	5.3	6.7E	17.0*
Type of disorder						
Mood disorder	4.0	11.1*	11.4*E	7.7	11.4*	25.2*
Anxiety disorder	3.0	8.5*	10.1*E	5.8	8.7*	17.7*
Disability day in past two weeks (mental)	1.2	3.0*E	5.5*E	2.0	3.8E	6.6*E

* significantly different from estimate for heterosexual population of same gender ($p < 0.05$)
E use with caution (coefficient of variation 16.6% to 33.3%)
Note: Missing values are excluded.
Source: 2003 and 2005 Canadian Community Health Survey (combined data).

Relatively large proportions of bisexuals reported mental health problems. Bisexual men were more than twice as likely as heterosexual men to perceive their mental health as fair or poor; for bisexual women, the proportion reporting fair or poor mental health was three times that of heterosexual women.

When respondents were asked if they had been diagnosed with a mood or anxiety disorder, all sexual minority groups reported levels above those for the heterosexual population. Such disorders were particularly prevalent among bisexual women, one in four of whom reported a mood disorder. The comparatively high prevalence of mood and anxiety disorders among gay men, lesbians and bisexuals was reflected in higher percentages reporting at least one disability day in the previous two weeks for mental or emotional reasons.

Health care

The use of health care services differed by sexual identity (Table 3). Compared with heterosexual men,

Table 3
Percentage consulting selected health care providers, lacking regular doctor, reporting unmet health care need and using preventive screening, by gender and sexual identity, household population aged 18 to 59, Canada, 2003 and 2005 combined

	Men			Women		
	Hetero-sexual	Gay	Bi-sexual	Hetero-sexual	Lesbian	Bi-sexual
	%	%	%	%	%	%
Consultation in past 12 months						
Family doctor or general practitioner	69.2	74.8*	72.1	82.6	76.9*	81.3
Medical specialist	19.0	29.4*	22.8	33.0	37.6	38.2
Nurse	8.4	14.7*	11.1	14.0	13.2	21.6*
Social worker or counsellor	3.5	6.8*E	9.3*E	5.7	8.6E	16.6*
Psychologist	2.5	7.7*	5.8*E	4.0	10.0*E	10.7*E
Alternative care provider	11.0	20.3*	13.4E	20.6	33.1*	27.3*
Self-help group	2.1	3.7*	4.5*E	3.0	6.5*E	9.4*
No regular doctor	21.9	22.2	26.2	11.6	19.0*	24.2*
Unmet health care need in past 12 months	10.9	14.2*	17.8*	14.8	19.6*	28.6*
Preventive screening						
Mammogram in past 2 years (aged 50 to 59)	...	...	...	71.1	71.9	49.0*
Pap test in past 3 years	...	...	...	77.1	64.0*	76.2

* significantly different from estimate for heterosexual population of same gender ($p < 0.05$)
E use with caution (coefficient of variation 16.6% to 33.3%)
... not applicable
Note: Missing values are excluded.
Source: 2003 and 2005 Canadian Community Health Survey (combined data).

gay men were more likely to have seen a family doctor, a medical specialist, or nurse in the previous 12 months. Utilization rates were also higher for social workers or counsellors, psychologists, alternative care providers, and self-help groups.

Consultations with doctors and nurses did not differ between bisexual and heterosexual men, but bisexual men had more frequent contact with social workers or counsellors and psychologists, and were more likely to report attending self-help groups.

Multivariate logistic regression models that controlled for predisposing, enabling and need characteristics were used to determine if sexual identity was independently associated with consulting health care professionals. Even when potentially confounding factors (notably, a higher prevalence of chronic conditions and mood disorders) were taken into account, compared with heterosexual men, gay men had increased odds of consulting medical specialists, nurses, social workers or counsellors, psychologists, and alternative care providers; bisexual men had higher odds for consultations with social workers or counsellors and alternative care providers (Table 4).

Among women, lesbians were slightly less likely to have seen a family doctor in the past 12 months, compared with heterosexual women, but more likely to have consulted psychologists and alternative care providers, and to have attended a self-help group (Table 3). Bisexual women had more contact with nurses, social workers or counsellors, psychologists and alternative care providers and were more likely to have attended self-help groups, compared with heterosexual women. Although odds ratios were somewhat attenuated in the multivariate regression models, the results were essentially unchanged (Table 5).

No regular doctor/Unmet health care needs

The proportions of gay, bisexual and heterosexual men who reported not having a regular doctor were statistically similar. Among women, the proportions who did not have a regular doctor were higher for lesbians and bisexuals than for heterosexuals. Results for both sexes remained the same when socio-demographic and health status variables were controlled in multivariate regression models.

Table 4
Unadjusted and adjusted odds ratios comparing gay and bisexual men with heterosexual men for selected health care provider consultations, lack of regular doctor and report of unmet health care need, household population aged 18 to 59, Canada, 2003 and 2005 combined

	Gay				Bisexual			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Consultation in past 12 months								
Family doctor or general practitioner	1.32*	1.09 to 1.59	1.18	0.95 to 1.45	1.15	0.85 to 1.56	1.23	0.88 to 1.71
Medical specialist	1.77*	1.47 to 2.12	1.40*	1.14 to 1.70	1.23	0.87 to 1.75	1.15	0.79 to 1.69
Nurse	1.88*	1.48 to 2.40	1.69*	1.32 to 2.17	1.33	0.94 to 1.90	1.23	0.86 to 1.74
Social worker or counsellor	2.01*	1.39 to 2.92	1.55*	1.01 to 2.38	2.71*	1.86 to 3.94	1.65*	1.10 to 2.46
Psychologist	3.21*	2.35 to 4.39	2.13*	1.46 to 3.11	2.29*	1.39 to 3.78	1.49	0.88 to 2.51
Alternative care provider	2.07*	1.68 to 2.54	1.89*	1.50 to 2.37	1.26	0.81 to 1.95	1.55*	1.00 to 2.39
Self-help group	1.71*	1.21 to 2.44	1.23	0.84 to 1.80	2.06*	1.22 to 3.48	1.30	0.75 to 2.24
No regular doctor	1.02	0.84 to 1.24	1.01	0.82 to 1.24	1.27	0.94 to 1.73	1.16	0.84 to 1.61
Unmet health care need in past 12 months	1.33*	1.06 to 1.67	1.17	0.92 to 1.48	1.76*	1.27 to 2.44	1.46*	1.02 to 2.09

* significantly different from estimate for heterosexual men ($p < 0.05$)

Notes: The following variables were controlled in the adjusted model: age (continuous), marital status, child(ren) under 12 in household, education (including missing values), income quintile (including missing values), place of residence, racial or cultural group, self-rated general health, number of chronic conditions, two-week physical disability day, self-rated mental health, anxiety disorder, mood disorder, two-week mental health disability day, having a regular doctor (except for regression models where not having a regular doctor is the outcome), and survey cycle.

Sources: 2003 and 2005 Canadian Community Health Survey (combined data).

Table 5
Unadjusted and adjusted odds ratios comparing lesbian and bisexual women with heterosexual women for selected health care provider consultations, lack of regular doctor, report of unmet health care need and use of preventive screening, household population aged 18 to 59, Canada, 2003 and 2005 combined

	Lesbian				Bisexual			
	Unadjusted		Adjusted		Unadjusted		Adjusted	
	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval	Odds ratio	95% confidence interval
Consultation in past 12 months								
Family doctor or general practitioner	0.70*	0.54 to 0.90	0.70*	0.53 to 0.92	0.94	0.71 to 1.24	0.97	0.70 to 1.34
Medical specialist	1.21	0.97 to 1.52	1.13	0.90 to 1.41	1.24	0.99 to 1.57	1.04	0.80 to 1.34
Nurse	0.91	0.69 to 1.20	0.90	0.67 to 1.21	1.69*	1.32 to 2.17	1.16	0.90 to 1.50
Social worker or counsellor	1.56*	1.04 to 2.35	1.36	0.85 to 2.18	3.29*	2.50 to 4.32	1.56*	1.14 to 2.15
Psychologist	2.65*	1.76 to 3.97	2.09*	1.32 to 3.31	2.86*	1.92 to 4.24	1.57*	1.05 to 2.35
Alternative care provider	1.91*	1.53 to 2.38	1.66*	1.32 to 2.09	1.47*	1.16 to 1.86	1.56*	1.24 to 1.96
Self-help group	2.24*	1.27 to 3.95	2.00*	1.10 to 3.64	3.34*	2.41 to 4.62	2.48*	1.76 to 3.48
No regular doctor	1.78*	1.36 to 2.33	1.68*	1.28 to 2.21	2.44*	1.86 to 3.19	2.04*	1.55 to 2.70
Unmet health care need in past 12 months	1.41*	1.07 to 1.85	1.24	0.92 to 1.68	2.32*	1.84 to 2.92	1.36*	1.04 to 1.78
Preventive screening								
Mammogram in past 2 years (aged 50 to 59)	1.03	0.67 to 1.60	1.20	0.78 to1.84	0.41*	0.22 to 0.76	0.46*	0.24 to 0.90
Pap test in past 3 years	0.52*	0.42 to 0.66	0.60*	0.47 to 0.77	0.96	0.73 to 1.25	1.32*	1.01 to 1.74

* significantly different from estimate for heterosexual women ($p < 0.05$)

Notes: The following variables were controlled in the adjusted model: age (continuous), marital status, child(ren) under 12 in household, education (including missing values), income quintile (including missing values), place of residence,racial or cultural group, self-rated general health, number of chronic conditions, two-week physical disability day, self-rated mental health, anxiety disorder, mood disorder, two-week mental health disability day, having a regular doctor (except for regression models where not having a regular doctor is the outcome), and survey cycle.

Sources: 2003 and 2005 Canadian Community Health Survey (combined data).

Gay men, lesbians and bisexuals were more likely than heterosexuals to report having had an unmet health care need in the past year. However, in multivariate regression models, only bisexual men and women had increased odds of reporting an unmet health care need.

Mammograms and Pap tests

The likelihood that women had had a mammogram in the past two years differed somewhat by their sexual identity. Lesbians and heterosexual women aged 50 to 59 had similar levels of utilization, but the proportion was much lower for bisexual women, a difference that persisted in multivariate regression models.

Receipt of the Papanicolaou (Pap) test also varied by sexual identity. Fewer than two-thirds of lesbians reported having had a Pap test within the past three years, well below the figures for heterosexual (77.1%) and bisexual women (76.2%). Results changed somewhat in multivariate regression models that accounted for differences in socio-demographic characteristics and health status. Compared with heterosexual women, lesbians still had reduced odds of having had a Pap test, but the odds for bisexual women were actually higher.

Discussion

Consultations with health care professionals varied by sexual identity, independent of socio-demographic and health status differences. As well, disparities were evident in the proportions who did not have a regular doctor and who reported unmet health care needs, and in women's receipt of two preventive cancer screening procedures (mammograms and Pap tests).

While the odds of consulting a family doctor in the past 12 months were similar for men regardless of their sexual identity, lesbians were less likely than heterosexual women to have done so. A possible reason could be some lesbians' unwillingness to disclose their sexual orientation to health care providers.[11,25] In fact, research has shown more use

of the health care system among lesbians who have told their doctor about their sexual orientation.[12,26] American studies have also demonstrated that some lesbians delay or avoid seeking care because of factors related to their sexual orientation such as fear of disclosing that they are lesbian to their doctor or past negative experiences.[9,11,13,25] Differences in childbearing[6] might also explain some of this disparity, although the CCHS results did not change when pregnant women and those who had given birth within the past two years were excluded from the regression model (data not shown).

The similar levels of contact with family doctors by gay, bisexual and heterosexual men was not unexpected. An American study showed that men living in same-sex relationships had increased odds of having visited a health professional in the past 12 months.[2] The authors suggested that the HIV epidemic might have made some gay men more likely to seek preventive care and to discuss HIV-related concerns, and to be more open to health care providers about their sexual orientation.

Utilization rates of health professionals who provide emotional or mental support were generally higher among gays, lesbians and bisexuals , mirroring other research.[3,16,27-30] It has been suggested that lesbians and bisexual women consider psychological counselling important,[31] and that a positive norm for using mental health services might exist in the gay, lesbian and bisexual communities.[28,32] As well, minority stress issues (the stress faced by individuals who belong to a stigmatized social category) could trigger seeking this type of care.[29,33]

Lesbians and bisexual women had high odds of not having a regular doctor, and bisexuals of both sexes had high odds of reporting unmet health care needs. Some evidence suggests that, compared with gay men, lesbians and bisexuals consider health care providers' attitudes toward non-heterosexual issues a more important factor when choosing a doctor.[34]

Women's use of preventive screening for cancer varied by sexual identity. While mammography rates among lesbians and heterosexual women aged 50 to 59 did not differ significantly, bisexual women were less likely to have ever had a mammogram. Results from other research have been mixed, with some studies showing lesbians less likely to have mammograms,[6,35,36] others showing no difference,[5,7,37] and one study showing higher rates.[38] The reason for the lower mammography rate among bisexual women is not known, but it is noteworthy because a large American non-probability study found that bisexual women aged 50 to 79 were more likely than other women to have breast cancer.[36]

Consistent with other research,[5,7,31,35-39] CCHS results showed that lesbians had lower rates of Pap test screening than did heterosexual and bisexual women. The impact of this difference is not known, as little or no data exist on rates of cervical cancer among lesbians.[6,40,41] Nonetheless, they have many of the same risk factors as heterosexual women, including unprotected sexual intercourse with men at some point in their lives.[42-45] As well, HPV (genital human papillomavirus) infection, a precursor to some cervical cancers, can be transferred between women through intimate sexual contact.[43,45] The lower screening rates among lesbians could be in response to past negative experiences with health care providers,[8-10,41] the belief that the test is not necessary,[41] or not usually taking birth control pills, renewal of prescriptions for which can be an opportunity for doctors to discuss and administer the Pap test.[6]

This study has several limitations. While survey questions that use the concept of sexual identity are considered to have excellent specificity (heterosexual people would not be classified as gay, lesbian or bisexual), their sensitivity has been criticized (some gay, lesbian and bisexual respondents would be classified as heterosexual).[22] Therefore, the CCHS results represent only people willing to self-identify as gay, lesbian or bisexual in an interview for a national survey. The degree of non-disclosure of sexual orientation is not known. Moreover, research has shown that a patient's "outness" predicts disclosure of sexual orientation to their health care providers, which has been associated with regular health care use.[26] Respondents who disclosed their sexual identity to a CCHS interviewer might be more open about their sexuality to others, and as a result, might be more inclined to use the health care system, compared

with other members of the gay, lesbian and bisexual communities.[12]

This analysis is based on self-reported data; no independent verification of the information was undertaken. The degree to which the data are biased because of reporting error is unknown.

The sample size for some characteristics of the gay, lesbian and bisexual populations is small, thereby limiting the statistical power to detect differences.

Health status was not fully controlled in the multivarate logistic regression models, as the severity of chronic conditions was not ascertained. Furthermore, HIV/AIDS status was not known.

The questions on mood and anxiety disorders are not standardized measurement tools, and should not be considered as measures of the prevalence of these disorders.

Conclusion

This analysis provides evidence, based on a national probability sample, that the use of health care in Canada varies by sexual identity, independent of predisposing, enabling and health need factors.

Overall, compared with the heterosexual population, gays, lesbians and bisexuals were more inclined to consult mental health service providers. Lesbians were less likely to have a regular doctor, and not surprisingly, had lower utilization rates of family doctors and of receipt of the Pap test. Compared with heterosexuals, bisexuals reported higher levels of unmet health care needs.

The reasons for the different care-seeking behaviours of the gay, lesbian and bisexual populations could not be ascertained with CCHS data and require further study. Nonetheless, the findings illustrate that gay men, lesbians and bisexuals should not be considered a homogenous group with regard to health care use, and should be analyzed separately in future studies.

These results are a first step in describing health care use patterns among adult Canadians who self-identify as gay, lesbian or bisexual. Further in-depth research would be useful to determine if the disparities persist across different segments of these groups (young and old, urban and rural), as well as the reasons for these disparities. ●

What is known on this topic?

- Gay, lesbian and bisexual Americans experience more barriers to health care than do heterosexual Americans.
- Most American studies show that lesbians and bisexual women undergo preventive cancer screening tests less frequently than do heterosexual women.
- Much of this research was based on non-probability surveys.

What does this study add?

- Gays, lesbians and bisexual Canadians have different health-care-seeking behavior than do other Canadians, independent of predisposing, enabling and health need factors.
- Disparities in health care use were particularly evident among lesbians, who are less likely to have a regular doctor and who have lower utilization rates of GPs and Pap tests.
- Bisexuals were more likely to report unmet health care needs, compared with heterosexual Canadians.
- Evidence from this study is based on a large national probability survey.

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Getting a second opinion: Health information and the Internet

by Cathy Underhill and Larry McKeown

In the little more than a decade since it was launched commercially, the Internet has changed the way Canadians conduct their everyday activities, from viewing weather, news and sports to banking and paying bills. The Internet has also changed the way many Canadians obtain health information, and potentially, their relationship with physicians.

In 2005, an estimated 8.7 million adults used the Internet to search for medical or health-related information, and of those in this group who visited a family doctor that year, more than a third discussed the information they obtained from their online search.

Based on findings from the 2005 Canadian Internet Use Survey (CIUS), this article examines adults' use of the Internet to access health information. The aim is to determine how individuals who use the Internet for health information differ from other Internet users and from people who do not use the Internet at all. The CIUS also identifies the types of searches conducted by those who sought health information.

Who accesses online health information?

An estimated 16.8 million Canadians aged 18 or older (68%) used the Internet for personal non-business reasons during 2005. Just over 15 million of them (about 90%) accessed it from home. Almost 6 of every 10 (58%) home Internet users went online at some point that year to search for health information.

CIUS respondents were divided into three groups according to their reported pattern of Internet use (see *The data*). An estimated 35% (8.7 million) were defined as *health users*, in that they went online at home during 2005 to search for health information. Another 25% (6.2 million) who went online at home that year, but not to search for health information, were defined as *other users*. The 32% (7.9 million) who reported that they had never used the Internet for personal, non-business reasons, or who had used it in the past, but not in the 12 months before the survey, were classified as *non-users*. A residual group (around 7% or 1.8 million) who used the Internet in 2005, but not from home, were excluded from this analysis because they were not asked about specific uses.

Women more likely than men to seek health information

Going online to search for health information in 2005 was related to social and economic characteristics (Table 1). Consistent with a previous study,[1] proportionately more women than men were health users.

Table 1

Socio-demographic characteristics of home Internet users and non-users, household population aged 18 or older, Canada excluding territories, 2005

	Health users	Other users	Non-users
Average age	41	40	58*
		%	
Female	55	45*	51
Married	56	50*	55
University degree	32	24*	7*
Employed	74	77*	44*
Children younger than 18 in household	42	44	21*
Urban	82	79*	69*
Household income more than $80,000	43	37*	13*

* significantly different from estimate for health users ($p < 0.01$)
Source: 2005 Canadian Internet Use Survey

The average age of health users and other users did not differ, but non-users were older than the other two groups. In addition, health users tended to have a higher level of education than either other users or non-users, and were more likely to report a higher household income.

Provincial differences

Provincial differences in the use of the Internet to search for health information mirrored overall Internet use, with a lower rate in Quebec compared with other provinces (data not shown). There was a slight urban-rural difference as well—people in small towns and rural areas were less likely than urban residents to use the Internet to obtain health information (28% versus 41%). However, when other factors were taken into account, this urban-rural difference disappeared.

Health users more engaged

Health users' overall online behaviour differed from that of other users (Table 2). Health users were more likely to access the Internet daily and to spend at least five hours a week online. They also reported more online activities, and were more likely to have been using the Internet for at least five years.

When selected socio-demographic and Internet use characteristics were considered together in a multivariate model, the primary predictor of whether Internet users would search for health information was the number of online activities in which they were engaged—as the "breadth of use" increased, so did their odds of seeking health information (Figure 1). Breadth of use appears to indicate a level of Internet sophistication: an individual capable of conducting a variety of activities via the Internet differs considerably from a novice learning to manage email.[2]

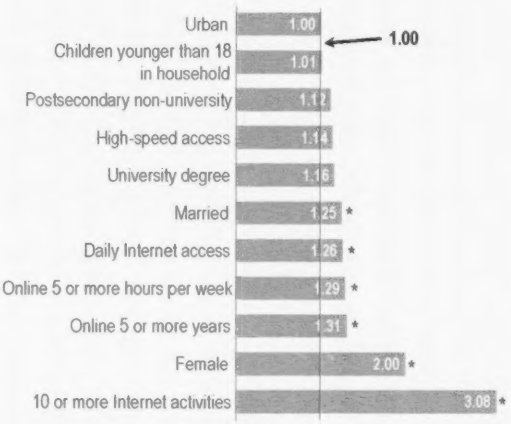
A number of demographic factors also played a significant role in determining whether an Internet user would search for health information. For women, the odds of being a health user were double those of men. Being married increased the odds of accessing health information, with odds for married individuals one and a quarter times those of unmarried individuals. The presence of children younger than 18 in the household was not a

Table 2
Internet characteristics of health users and other users, household population aged 18 or older, Canada excluding territories, 2005

	Health users	Other users
Average number of activities	10.1	7.4
	%	
Online 5 or more years	72	59*
Daily Internet access	72	56*
Online 5 or more hours per week	52	36*
Cable, satellite or high-speed connection	84	78*
10 or more Internet activities	57	31*
Electronic banking	64	50*

* significantly different from estimate for health users ($p < 0.01$)
Source: 2005 Canadian Internet Use Survey

Figure 1
Odds ratios relating selected socio-demographic and Internet use characteristics to accessing health information online, household population aged 18 or older, Canada excluding territories, 2005



* significantly different from estimate for reference category ($p < 0.01$)
Notes: Reference category is absence of characteristic; for example, reference category for "married" is "not married." Household income was not included because of high correlation with education. Respondent age was entered as a continuous control variable.
Source: 2005 Canadian Internet Use Survey.

significant predictor of being a health user, a finding similar to that of other research.[3]

Other important predictors included the number of years an individual had been online, frequency of use, and intensity of use (see *The data*).

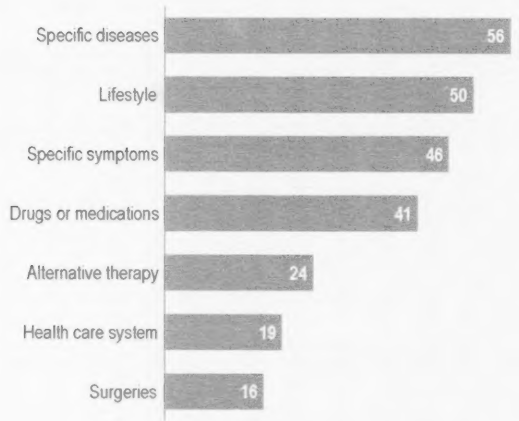
Specific diseases

Health users most commonly searched for information on specific diseases, with 56% (nearly 5 million) using the Internet for this purpose (Figure 2). Half of health users reported searching for particulars on lifestyle factors, such as diet, nutrition and exercise. Other topics frequently investigated were specific symptoms, drugs or medications, and alternative therapies. A similar pattern in search types was found among American Internet users.[4]

About three-quarters of health users searched for information on three or fewer topics, while the remaining quarter searched in at least four areas.

The type of information sought by health users varied with their age and sex. Proportionately more 18- to 44-year-olds looked for information on lifestyle and the health care system, while comparatively more aged 45 or older sought information on specific diseases and on drugs or medications.

Figure 2
Percentage of health users, by type of search, household population aged 18 or older, Canada excluding territories, 2005



Source: 2005 Canadian Internet Use Survey

Table 3
Health users, by age, sex and type of search, household population aged 18 or older, Canada excluding territories, 2005

Type of search	18 to 44		45 or older	
	Men	Women	Men	Women
	%		%	
Lifestyle	52	53	44	48
Specific diseases	49	55*	59	66*
Specific symptoms	48	49	43	43
Drugs or medications	34	41*	44	48
Health care system	22	20	19	15*
Alternative therapy	19	26*	23	27
Surgeries	15	16	18	17

* significantly different from estimate for men in same age group ($p < 0.05$)
Source: 2005 Canadian Internet Use Survey

Regardless of age, female health users were more likely than male health users to seek information about specific diseases (Table 3). At ages 18 to 44, a higher percentage of women than men sought details about drugs or medications and about alternative therapies. At age 45 or older, men were more likely than women to look for information on the health care system or health care delivery.

Regional differences in search types were apparent (data not shown). For example, health users in Atlantic Canada were more likely to search for particulars about lifestyle (58%) and about drugs or medications (46%), compared with health users overall (50% and 41%, respectively). People in British Columbia were more likely to investigate alternative therapies (28% versus 24%). In Quebec, the proportion of health users seeking information on specific diseases (61%) exceeded the national figure (56%). By contrast, the proportion in Quebec searching for lifestyle information (44%) was significantly below the national level (50%).

A second opinion

More than a third (38%) of health users reported that they had discussed their findings with a family doctor or health care provider. Individuals searching

The data

This article is based on data from the 2005 Canadian Internet Use Survey (CIUS). Conducted in November 2005, the survey asked 30,466 Canadian residents aged 18 or older about their personal Internet use in the previous 12 months. As a supplement to the Labour Force Survey (LFS), the CIUS excludes residents of the territories, inmates of institutions, residents of Indian reserves, and full-time members of the Canadian Forces.

Population estimates are based on a CIUS person-weight, derived after adjustments to the LFS sub-weight. Standard errors and coefficients of variation are estimated using the bootstrap technique to account for survey design effects. More information on definitions, data sources and methods is available on the Statistics Canada website.[5]

Respondents to the 2005 CIUS were asked, "Have you ever used the Internet from home, work, school, or any other location for personal non-business use?" Those who reported personal, non-business use of the Internet at home were asked about a number of specific uses, including, "During the past 12 months, have you used the Internet at home to search for medical or health-related information?" An affirmative response led to a series of questions about medical and health use of the Internet. For example, "During the past 12 months, what kind of medical or health-related information did you search for using the Internet?" A list of possible responses was read to the respondents: lifestyle; alternative therapy; health care system or delivery; drugs or medication; surgeries; specific diseases; analysis of specific symptoms; or other. Respondents were then asked if they had communicated with their family doctor about their own health or that of another family member in the past 12 months. Those who had done so were asked, "During the past 12 months, have you discussed with your family doctor or general practitioner, medical or health information you obtained from the Internet?"

An *Internet user* is someone who used the Internet from any location in 2005 for personal, non-business reasons. A home-user is someone who reported using the Internet from home, for the same reasons.

Respondents who reported using the Internet from home to search for medical or health-related information were classified as *health users*.

Other users were respondents who used the Internet from home, but not to search for medical or health-related information.

Respondents who reported that they had never used the Internet for personal, non-business reasons, or who had used it, but not in the past 12 months, were classified as *non-users*.

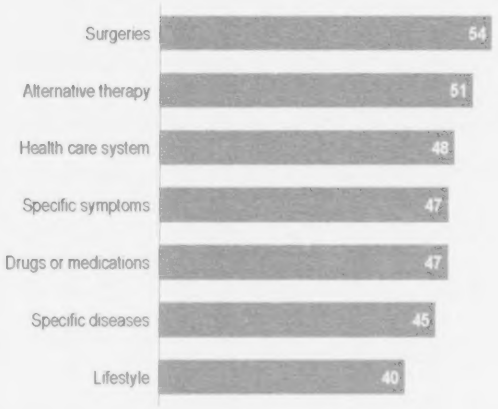
Duration of Internet use was measured in number of years respondents had been online.

Intensity of Internet use was measured in hours online per week.

Breadth of Internet use was measured by number of reported Internet activities in which the respondent engaged.

for information on surgeries were particularly likely to have done so (Figure 3). In fact, over half (54%) of people who sought information on surgeries and who had contacted a doctor during 2005 reported that they had discussed their Internet findings with a family doctor or health care provider.

Figure 3
Percentage of health users who discussed online health information with family doctor, by type of search, household population aged 18 or older, Canada excluding territories, 2005



Source: 2005 Canadian Internet Use Survey.

Summary

In 2005, more than one-third of Canadian adults used the Internet to search for health information. And of those who also visited a doctor, more than one-third discussed the results of their Internet search with their physician.

This study raises important considerations. First, it is anticipated that as more Canadians access the Internet, online searches for health information will increase. However, the accuracy and reliability of Internet information on any topic can vary widely. Internet sources of health information range from personal accounts of illnesses and patient discussion groups to clinical decision tools and peer-reviewed journal articles.

Second, the use of the Internet to search for health information appears to be unevenly distributed among Canadians. Searching for health information online is an example of what has been described as a second level digital divide among Internet users.[6]

Cathy Underhill (613-951-6023; Cathy.Underhill@statcan.ca) and Larry McKeown (613-951-2582; Larry.Mckeown@statcan.ca) are with the Science, Innovation and Electronic Information Division at Statistics Canada, Ottawa, Ontario, K1A 0T6.

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An algorithm to differentiate diabetic respondents in the Canadian Community Health Survey

Edward Ng, Kaberi Dasgupta and Jeffrey A. Johnson

Abstract

Objectives

This article describes an algorithm to classify respondents to cycle 1.1 (2000/2001) of the Canadian Community Health Survey (CCHS) according to whether they have type 1, type 2 or gestational diabetes.

Data source

The data are from the chronic disease module and the drug module of cycle 1.1 of the CCHS.

Analytical techniques

A total of 6,361 respondents to cycle 1.1 of the CCHS reported that a health care professional had diagnosed them as having diabetes. The Ng-Dasgupta-Johnson algorithm classifies this group according to whether they have type 1, type 2 or gestational diabetes, based on their answers to CCHS questions about diabetes during pregnancy, use of oral medications to control diabetes, use of insulin, timing of initiation of insulin treatment, and age at diagnosis.

Main results

Application of an earlier algorithm to CCHS cycle 1.1 results in a 10%-90% split for type 1 and type 2 diabetes. By contrast, the Ng-Dasgupta-Johnson algorithm yields a 5%-95% split. This is not unreasonable, given the rapid rise in obesity, a major risk factor for type 2 diabetes, in Canada.

Keywords

Chronic disease, classification, data collection, health surveys, insulin

Authors

Edward Ng (613-951-5308; Edward.Ng@statcan.ca) is with the Health Information and Research Division at Statistics Canada in Ottawa, Ontario K1A 0T6; Kaberi Dasgupta is with the Division of Internal Medicine and Epidemiology at McGill University in Montreal, Quebec; and Jeffrey A. Johnson is with the School of Public Health at the University of Alberta in Calgary, Alberta.

Diabetes is a serious chronic condition characterized by high levels of glucose, the body's primary fuel. Normally, glucose is transferred from the circulation system into tissue cells through the action of insulin, a hormone produced by the pancreas. In patients with type 1 diabetes, high glucose levels result from a lack of insulin production. For patients with type 2 or gestational diabetes, glucose levels rise because of resistance to the action of insulin. Although gestational diabetes may resolve post-partum, women with this condition are at increased risk of developing type 2.[1]

Very high glucose levels can cause fatigue, dehydration, and even death. More moderate but long-term elevations of glucose levels can contribute to injury of blood vessels, which, in turn, can result in complications such as blindness, kidney injury, heart disease and stroke.[2-5] Because of its adverse health effects and the associated economic burden on the health care system,[6,7] diabetes is a major public health problem.

Recent literature suggests that the prevalence of diabetes is rising, not only in Canada, but worldwide.[8,9] It is likely that this increase is due primarily to the growing number of people with type 2 diabetes.[8,9] The insulin resistance that leads to type 2 diabetes results from a combination of excess body weight, physical inactivity, and genetic factors. Tellingly, the increasing prevalence of type 2 diabetes has paralleled the rise in obesity, which is a risk factor.

Because of differences in etiology, associated risk factors, costs, and prevention strategies for type 1 and type 2 diabetes, it is important for public health surveillance to be able to track their prevalence.[10] Data on diabetes are collected by Statistics Canada's Canadian Community Health Survey (CCHS). The CCHS is a nationally representative population survey that contains questions about a host of chronic conditions and a comprehensive array of demographic, socio-economic, health and lifestyle variables. Thus, potentially, the CCHS can be used to monitor the prevalence of diabetes in Canada and to study associations with risk factors. A major limitation of these data, however, is that the survey does not directly ask respondents about diabetes type.

This article describes a new algorithm based on cycle 1.1 (2000/2001) of the CCHS, which is designed to identify respondents according to whether they have type 1, type 2 or gestational diabetes.

Diabetes questions in the Canadian Community Health Survey

The CCHS covers the population aged 12 or older living in private households. It does not include people on Indian reserves, on Canadian Forces bases, or in some remote areas. The first cycle (1.1) was conducted from September 2000 through October 2001. The overall response rate for cycle 1.1 was 85%; the total sample size was 131,535.

The chronic disease module of the CCHS contains six questions that deal specifically with diabetes:

CCCA_101	Do you have diabetes?
CCCA_102	How old were you when this was first diagnosed?
CCCA_10A	Were you pregnant when you were first diagnosed with diabetes? (asked of women aged 15 or older)
CCCA_10B	Other than during pregnancy, has a health professional ever told you that you have diabetes? (asked of women who had diabetes during pregnancy)
CCCA_10C	When you were first diagnosed with diabetes, how long was it before you were started on insulin? Less than 1 month 1 month to less than 2 months 2 months to less than 6 months 6 months to less than 1 year 1 year or more Never
CCCA_105	Do you currently take insulin for your diabetes?

As well, the drug module of the CCHS contains questions about diabetes medications:

In the past month, that is, from (date one month ago) to yesterday, did you take:

DRGA_1N	. . . insulin?
DRGA_1O	. . . pills to control diabetes?

Creating an algorithm

To create an algorithm to classify CCHS respondents who report diabetes as being type 1, type 2 or gestational cases, it is necessary to understand the nature of these forms of the disease and differences in they way they are treated. Type 1 and type 2, in particular, differ not only in etiology, but also in treatment.

People with type 1 diabetes produce little or no insulin. In type 1, the pancreas cannot produce insulin, so it must be replaced. Therefore, treatement for type 1 invariably requires insulin injections. Type 1 usually develops during childhood or adolescence.[3]

In type 2 diabetes, the pancreas continues to produce insulin, but the body develops resistance to its effects, resulting in a relative insulin deficiency. Glucose control in type 2 diabetes may be achieved with weight reduction, exercise, and oral medications, although insulin production may become impaired over time, and many patients eventually require insulin treatment.[11-13] Type 2 typically occurs in adulthood after age 30,[12] and becomes progressively more common with

advancing age. However, rates of type 2 among children and adolescents are rising, largely as a result of the increasing prevalence of obesity.[14,15]

Gestational diabetes occurs in about 4% of all pregnancies.[16] Identifying gestational diabetes from the CCHS is relatively simple; the principal challenge is differentiating between types 1 and 2.

Given the differences in age of onset and treatment, it is possible to classify CCHS respondents as having type 1 or type 2 diabetes, based on their answers to questions about these factors. For example, age of diagnosis before 30 might be used to identify type 1 patients. Based on this criterion, close to 10% of the CCHS sample who reported diabetes would be classified as type 1 (n=608), a proportion consistent with previous studies.[3] However, responses to questions about medication use indicate that approximately half of these respondents started insulin treatment six months or more after they had been diagnosed, even though type 1 patients generally require insulin treatment within six months of diagnosis.[17] This suggests that some of the patients identified as type 1 based on the age 30 criterion would be misclassified. This possibility is bolstered by the increasingly younger age at which type 2 diabetes is being diagnosed.[14,15] As well, using insulin cannot definitively categorize patients as type 1 or type 2, given that insulin use is not confined to type 1 patients. Therefore, a combination of age and medication use criteria is needed to distinguish between types 1 and 2.

The Maddigan-Johnson algorithm

An algorithm to classify CCHS respondents as having type 1 or type 2 diabetes was developed by Maddigan-Johnson (MJ) in 2006.[18] This algorithm (Figure 1) employs six CCHS questions: 1. has diabetes; 2. use of insulin; 3. age at first diagnosis; 4. timing of insulin treatment; 5. age of respondent; and 6. use of oral medications.

The MJ algorithm classifies the 6,361respondents reporting diabetes who used an oral medication as type 2, regardless of insulin use. Respondents using neither oral medications nor insulin are also classified as type 2. Those not using an oral medication, but using insulin, and who were younger than age 30 at

Figure 1
Maddigan-Johnson algorithm

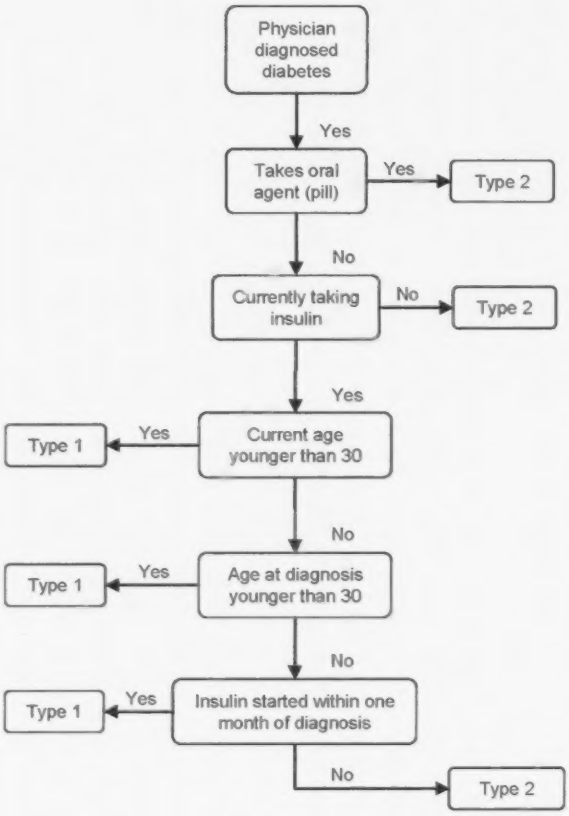
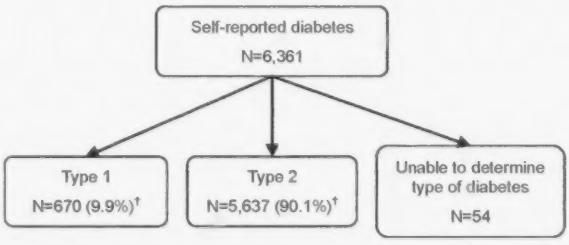


Figure 2
Survey sample, analysis sample and missing data for diabetic population based on Maddigan-Johnson algorithm



† Percentage represents weighted population percentage based on respondents who could be categorized as having type 1 or type 2 diabetes.
Source: 2000/2001 Canadian Community Health Survey, cycle 1.1.

the time of diagnosis or at the time of the interview, or who had started insulin therapy within one month of diagnosis, are classified as type 1. According to the MJ algorithm, the type1–type 2 split was 10%–90% (Figure 2). However, 54 diabetic respondents were not classified, because they did not answer any of the six questions used in the algorithm.

While the MJ algorithm is an important first step in distinguishing between type 1 and type 2 diabetes, it has some limitations. First, it is not explicit in how missing information (refusal, don't know, etc.) should be treated. Second, some people with type 1 diabetes may not start insulin therapy within a month of diagnosis if they have some response to oral medications (although all will require insulin within six months). And third, it is not clear how women with gestational diabetes are classified in the MJ algorithm.

The Ng-Dasgupta-Johnson algorithm

The proposed Ng-Dasgupta-Johnson (NDJ) aims to overcome the limitations of the MJ algorithm. It makes explicit the decisions with regard to dealing with missing information. It also uses the gestational diabetes question in the diabetes module, in which female respondents who report diabetes are asked if this had been only during pregnancy. Those who answer "yes" (that is, they had only gestational diabetes) skip out of the diabetes module to the questions in the next chronic disease module, and thus, cannot be classified by the MJ algorithm. The 54 cases of unknown type identified by the MJ algorithm may all be "gestational diabetes."

The NDJ algorithm requires seven steps to identify respondents to cycle 1.1 of the CCHS as having type 1, type 2 or gestational diabetes (Figure 3):

Step 1. Target population: Respondents who replied "yes" to having diabetes (CCCA_101=1) (n=6,361). These 6,361 respondents constitute the diabetes cohort. Those who did not know, refused to answer or did not respond were excluded (87).

Step 2. Gestational diabetes: If the respondents were women who said that they had not been diagnosed with diabetes at any time other than when they were pregnant (CCCA_10B=2) and the age of diagnosis was 15 to 49 (childbearing age range), they were considered to be cases of gestational diabetes.
Screening forward: Respondents in the diabetes cohort not asked this question (males; females younger than 15), women who reported being diagnosed with diabetes during pregnancy and at another time ("yes" to CCCA_10B), and those who did not answer were moved forward.

Step 3. If respondents reported taking an oral medication (DRGA_1O=1), they were assigned type 2 diabetes.
Screening forward: If the response was "no," "not applicable," "don't know" or "not stated," they were moved forward. (The question about oral medications was asked of about 24% of all respondents in cycle 1.1, as only selected health authorities in Ontario used this question.)

Step 4. If the respondents were not currently taking insulin (CCCA_105=2), they were assigned type 2 diabetes.
Screening forward: If the response was "yes," "not applicable" or "don't know," they were moved forward.

Step 5. If the respondents were younger than 30 and began taking insulin within 6 months of being diagnosed, they were assigned type 1 diabetes.
Screening forward: If the respondents were 30 or older or began taking insulin 6 or more months after being diagnosed, they were moved forward.

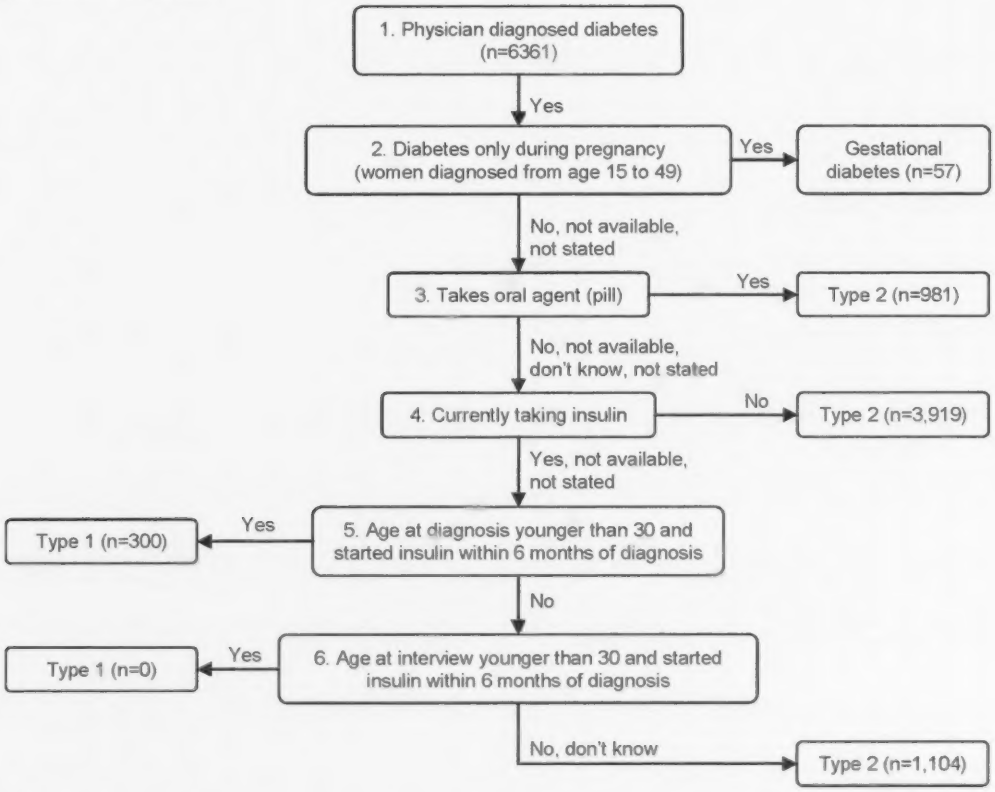
Step 6. If the respondents' age of diagnosis was younger than 30 and they began taking insulin within 6 months of being diagnosed, they were assigned type 1 diabetes.
Screening forward: If the respondents' age of diagnosis was 30 or older or if they did not know or refused to answer this question, or if they had started taking insulin more than 6 months after being diagnosed, they were moved forward.

Step 7. All the remaining respondents were assigned type 2 diabetes, regardless of when they started taking insulin.

The MJ algorithm used the timing of the start of insulin treatment to assign some of the Step 7 respondents to type 1; specifically, those who began taking insulin within one month of diagnosis. However, about half of them were aged 50 or older when they were diagnosed, and so are far more likely to be type 2.

Table 1 contains the variable names, description, code, sample size, and frequency of the above-

Figure 3
Ng-Dasgupta-Johnson algorithm


1. Physician diagnosed diabetes (n=6361)
Yes
2. Diabetes only during pregnancy (women diagnosed from age 15 to 49)
Yes
Gestational diabetes (n=57)
No, not available, not stated
3. Takes oral agent (pill)
Yes
Type 2 (n=981)
No, not available, don't know, not stated
4. Currently taking insulin
No
Type 2 (n=3,919)
Yes, not available, not stated
5. Age at diagnosis younger than 30 and started insulin within 6 months of diagnosis
Yes
Type 1 (n=300)
No
6. Age at interview younger than 30 and started insulin within 6 months of diagnosis
Yes
Type 1 (n=0)
No, don't know
Type 2 (n=1,104)

Notes: Sample size is listed in parenthesis. In CCHS cycle 1.1, the question about oral agents was asked only in selected Health Authorities in Ontario; thus, just 31,187 respondents, or 24% of the overall sample, were asked this question.
Source: 2000/2001 Canadian Community Health Survey, cycle 1.1.

mentioned variables for all CCHS respondents. Table 2 contains the same information for respondents who reported that they had been diagnosed with diabetes by a health professional.

Results

The main difference between the MJ and NDJ algorithms is the shift in the proportions classified as type 1 and type 2 diabetes. While the MJ algorithm results in a 10%–90% split, the NDJ algorithm yields a 5%–95% split (figure 4), which is not unreasonable, given the rapid rise in obesity[19,20] and type 2 diabetes in Canada and around the world.[2,21]

The characteristics of type 1 and type 2 diabetic respondents identified by the NDJ algorithm reflect the variables used to make this assignment (Table 3). By definition, all type 1 respondents were currently taking insulin and had been diagnosed when they were younger than 30. No type 1 respondents had taken oral anti-diabetic medications in the past month, whereas this was the case for 16% of those classified as type 2. However, 75% and 74% of type 1 and 2 respondents were not asked this question, as it was included only in the optional sub-module of CCHS cycle 1.1.

The timing of the start of insulin is used to differentiate between diabetes types at the end of the MJ algorithm, and to be classified as a type 1 case, respondents had to have begun insulin treatment within one month of diagnosis. The NDJ algorithm also uses this question, but broadens the

Table 1
Information used to determine diabetes type (types 1, 2 and gestational plus unable to determine), total sample, Canadian Community Health Survey, cycle 1.1, (n=131,535)

			Response						
Variable name	Variable description		Yes	Other	No	Not applicable	Don't know	Refusal	Not stated
CCCA_101	Has diabetes	Code	1	...	2	6	7	8	9
		Sample	6,361	...	125,087	...	61	1	25
CCCA_10B	Diagnosed other than when pregnant	Code	1	...	2	6	...	...	9
		Sample	143	...	58	131,262	...	...	72
DRGA_1O	Pills used in past month	Code	1	...	2	6	7	...	9
		Sample	998	...	30,136	100,348	23	...	30
CCCA_105	Currently taking insulin	Code	1	...	2	6	7	...	9
		Sample	1,530	...	4,766	125,145	7	...	87
DHHA_AGE	Current age	Code	12-102	...	...	...	...	...	...
		Sample	131,535	...	...	...	...	...	...
CCCA_102	Age at diagnosis	Code	0-92	...	...	996	997	998	999
		Sample	6,319	...	...	125,087	40	2	87
CCCA_10C	Time between diagnosis and starting insulin	Code	< 1 month	Other	Never	96	97	...	99
		Sample	915	943	4,413	125,145	32	...	87

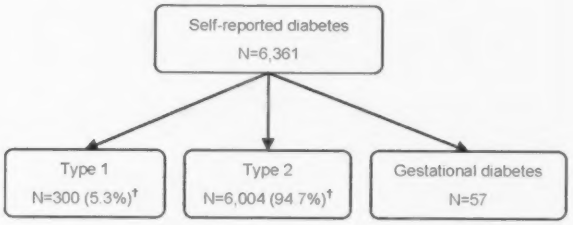
... not applicable
< less than
Source: 2000/2001 Canadian Community Health Survey, cycle 1.1.

Table 2
Information used to determine diabetes type (types 1, 2 and gestational plus unable to determine), diabetic sample, Canadian Community Health Survey, cycle 1.1, (n=6,361)

			Response						
Variable name	Variable description		Yes	Other	No	Not applicable	Don't know	Refusal	Not stated
CCCA_101	Has diabetes	Code	1	...	2	6	7	8	9
		Sample	6,361	...	...	...	...	...	...
CCCA_10B	Diagnosed other than when pregnant	Code	1	...	2	6	...	...	9
		Sample	143	...	58	6,134	...	...	26
DRGA_1O	Pills used in past month	Code	1	...	2	6	7	...	9
		Sample	984	...	646	4,729	1	...	1
CCCA_105	Currently taking insulin	Code	1	...	2	6	7	...	9
		Sample	1,530	...	4,766	58	7	...	...
DHHA_AGE	Current age	Code	< 30	...	≥ 30	...	...	...	...
		Sample	187	...	6,174	...	...	...	...
CCCA_102	Age at diagnosis	Code	< 30	...	≥ 30	996	997	998	999
		Sample	645	...	5,674	...	40	2	...
CCCA_10C	Time between diagnosis and starting insulin	Code	< 1 month	Other	Never	96	97	...	99
		Sample	915	943	4,413	58	32	...	...

... not applicable
< less than
≥ greater than or equal to
Source: 2000/2001 Canadian Community Health Survey, cycle 1.1.

Figure 4
Survey sample for diabetic population based on Ng-Dasgupta-Johnson algorithm



† Percentage represents weighted population percentage based on respondents who could be categorized as having type 1 or type 2 diabetes.
Source: 2000/2001 Canadian Community Health Survey, cycle 1.1.

Table 3
Characteristics of diabetes types 1 and 2 as assigned by Ng-Dasgupta-Johnson algorithm, Canadian Community Health Survey, cycle 1.1

	Type 1 (n=300)	Type 2 (n=6,004)
	% (unweighted)	
Has diabetes		
Yes	100	100
No	0	0
Diagnosed other than when pregnant		
Yes	5	2
No/Not applicable/Not stated	95	98
Pills used in past month		
Yes	0	16
No	25	9
Not asked	75	74
Currently taking insulin		
Yes	100	20
No/Not applicable/Not stated	0	80
Current age		
Less than 30	37	1
30 or older	63	99
Age at diagnosis		
Less than 30	100	5
30 or older/Not stated	0	95
Time between diagnosis and starting insulin		
Less than 1 month	94	11
1 to less than 2 months	2	1
2 to less than 6 months	4	1
6 months to less than 1 year	0	2
1 year or more	0	12
Never	0	74
Not applicable/Don't know	0	1

Source: 2000/2001 Canadian Community Health Survey, cycle 1.1.

interval between diagnosis and the start of insulin treatment to six months. Based on the NDJ algorithm, 94% of the newly assigned type 1 cases had started insulin within one month of diagnosis, compared with just 11% of the newly assigned type 2 cases. By design, none of the type 1 cases had started insulin more than 6 months after diagnosis, compared with 14% of type 2 cases.

About 5% of type 2 patients (308 respondents) identified by the NDJ algorithm had been diagnosed when they were younger than 30; in fact, 81 of them had been younger than 16. This raises the possibility that they were misclassified, and perhaps should be type 1. However, of these 308 cases, 41 were taking an oral anti-diabetic medication and 198 of the remaining 267 cases were not taking insulin, and so were more likely to have type 2 than type 1. Of the remaining 69 cases, only 19 had been diagnosed when they were younger than 16. Given the recent increases in type 2 diabetes in young adults and children,[14,15] it is reasonable to expect this number of younger respondents among those classified as type 2. Therefore, misclassification, if any, is not serious.

Beyond the type 1—type 2 distinction, other forms of diabetes are being recognized. As noted above, the NDJ algorithm takes account of the increase in "maturity onset diabetes of the young" (MODY), that is, a form of type 2 diabetes appearing in younger people. Other emerging forms include "latent autoimmune diabetes of adulthood" (LADA) and "latent autoimmune disease in youth" (LADY).[22] However, the prevalence of the last two conditions would be negligible in the population-based surveillance data that CCHS provides.

A potential criticism of the NDJ algorithm is that only 24% of cycle 1.1 respondents were asked about oral medications (Step 3). However, the question on the use of pills for diabetes control is no longer optional content, and was asked of everyone who reported diabetes in cycles 3.1 and 4.1. Application of the NDJ algorithm to cycle 3.1 yielded prevalence estimates of type 1 and type 2 similar to those derived from cycle 1.1.

The number of CCHS respondents reporting physician-diagnosed diabetes rose from 6,361 in

2000/2001 (CCHS 1.1) to 8,200 in 2005 (CCHS 3.1); the corresponding weighted estimates of the number of people with diabetes increased from 1,064,000 to 1,325,000. The distribution of these cases by type over this period varied little, with the proportion identified as type 1 fluctuating around 4% to 5%. Gestational diabetes consistently represented about 1% of cases

Conclusion

The Ng-Dasgupta-Johnson algorithm expands upon the Maddigan-Johnson algorithm in attempting to classify type 1, type 2 and gestational diabetes based on self-reported information from cycle 1.1 of the CCHS. While the NDJ algorithm was developed using cycle 1.1, it can be applied to other CCHS cycles. Although a potential for misclassification exists, this is likely minor, and is overshadowed by the benefits of classifying the majority of diabetic respondents in this nationally representative survey.

Nonetheless, further development and validation of the NDJ algorithm are needed. No external criteria exist, so sensitivity and specificity measures cannot be derived. A possible method of validation of the algorithm is against hospital discharge data, specifically, through the recently linked files of the CCHS and a person-oriented version of the CIHI Hospital Morbidity Database. This database contains ICD-10-CA diagnostic codes (E10-E14) that identify diabetes type.[23,24] Using the hospitalization record as a "gold standard," it may be possible to determine if CCHS respondents identified as having type 2 diabetes by the NDJ algorithm are similarly identified in hospital records.

Another possibility is to include a question about diabetes type in the CCHS itself. However, some people may not know what type of diabetes they have; type 2 patients taking insulin may believe they have type 1.

The new Canadian Health Measures Survey (CHMS), data from which will be available in 2010, contains a number of questions about diabetes. Respondents are directly asked about type of diabetes (type 1, type 2 or gestational), age at first diagnosis, and medication used. They also undergo blood tests which measure glycohaemoglobin (HbA1c), glucose (fasting or random), and fasting insulin. The CHMS results will offer an opportunity to determine if diabetic respondents can correctly identify the type of diabetes that they have. ●

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